

Railroad Age Gazette

Including the Railroad Gazette and The Railway Age

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The two Holland interurban sleeping cars which were put into service on the Illinois Traction System in February, 1907 (*Railroad Gazette*, February 22, 1907), have more than paid their way, which the company feels is as much as it has a right to expect. These cars have been running between Springfield and East St. Louis. The latter is not a good terminal because of the annoyance to passengers of having to cross the river. Experience with these two cars, which are the only ones of the kind ever built, has shown them to be not very well designed for the service. Among other things it is evident that motors and air pumps should not be applied to interurban sleeping cars. They should be trail cars. The Illinois Traction System has just ordered two new sleeping cars which will be trailers, and built on the order of a Pullman. They will be run between Peoria and East St. Louis until the Illinois Traction System completes its bridge at St. Louis, when they will run into the city. The officers of this company are confident that eventually a low fare sleeping car service will be established over the entire territory served by their lines, and that it will be profitable and popular. The

electric interurban roads at present have mostly a daylight earning capacity. The night earning power must be developed, in such ways as this company is using. We understand the berth rate between Springfield and East St. Louis is \$1.

The problems arising out of claims for loss and damage to freight (extracts from a paper on this subject have appeared in recent issues of the *Railroad Age Gazette*), seem to arise as the natural outcome of department organization. If the men who handle the freight are hired by the operating department, represented by the division superintendent, while the work of adjusting the claims is handled by the freight or claim department, and if these separate departments operate independently, the existing conditions in freight claims must in great part be expected. The division superintendent rarely knows much about the way things are going in the claim department and when he is called upon to pass on the responsibility of claims it is quite likely that the claims have been paid. Unless he is in direct touch with the far more numerous instances of misloaded or damaged freight, he is of little or no assistance in the work of bettering the condition. A superintendent of a southern railroad recently said in conversation: "I notice that the division superintendents whom I meet do not seem to take much interest in such matters, probably because they are not handled in their departments. If they received every month a statement of the losses on their divisions caused by carelessness of their men they would feel like giving the matter more attention." The constant and essential demands of the general managers to reduce expenses in times of declining business react decidedly through the claim department. Simultaneously with the dropping off of business, the force is cut. When the increase of business comes, the policy seems to be to hold off making additions to the force as long as possible, and when new men are finally hired, they are often men who know little or nothing about the business, and have a natural aptitude for blunders. The final correction of such blunders lies in the payment of the claims which have resulted. There will always be claims to pay, and the problem is a separate one for each railroad to solve. For instance, if economy in the car department of any road is forced to such an extent that a large portion of its cars in use have leaky roofs, the claim department must expect to pay for freight damaged by water. It is useless to instruct the agents not to load leaky roof cars when others cannot be obtained. If one clerk is expected to check in freight of four and five cars, there should be little wonder at his making mistakes. The station agent who is busy at the wire when local freight is being unloaded cannot check it. If he reports shortages or damage, the train crew of the local report that it was O. K. when unloaded. When an agent refuses to receive freight because it is not properly packed, the commercial agent reports him as "offending patrons and causing business to be diverted." This condition of affairs could be helped if, on each division, there were some person who could review the mistakes soon after they happened, and could personally attend to correcting them at once. The investigations of the claim department are generally of no real use, being handled by a clerk who works with the idea of turning out a given amount of claims per day, regardless of their character.

DIFFUSION OF OWNERSHIP AND EFFICIENCY.

Judge Peter S. Grosscup's specific for modern industrial and economic ills is what he once called the "peopleization of industry." Being interpreted, this means the general diffusion of the ownership of the stock of large corporations. Judge Grosscup elaborated his theory recently in an address before the American Academy of Political and Social Science, which is published in the *Annals of the Academy* for July. It is an instinctive trait of the Anglo-Saxon, says the eminent jurist, to desire a place all his own in the industrial, as well as in

the political and social structure. The advent of the corporation has tended to deprive him of the opportunity to gratify this desire. Most of the people, instead of investing their capital in the stock of corporations, deposit it in the banks, which loan it to the relatively small number of men who control the corporations. The "tremendous shift that has taken place in this country, away from individual participation by the people of the country in direct ownership of the industries of the country" is "the real cause that lies at the bottom of this industrial disturbance, is the same cause that has lain throughout all our years of prosperity at the bottom of the people's unrest in the midst of prosperity. * * * Failing to distinguish between the corporation abstractly, as a medium through which to wield our national energies, and the particular corporations that have abused that function, we look upon incorporated property, merely because it is incorporated, as the foe and oppressor of the individual man." The remedy, Judge Grosscup concludes, is to get the people to secure control of the corporations by investing directly in their stocks.

The application of Judge Grosscup's theory to the railroad business would involve a large relative reduction of railroad bonds and increase of railroad stocks; if the people's capital is to be transferred from the loan market to the investment market there must be a corresponding change in the nature of the securities bought with it. The resulting relative reduction in the fixed charges of railroads would be a protection to them, and indirectly to the entire commerce and industry of the country, in times of financial stress.

The general diffusion of the ownership of railroad stocks undoubtedly would have some other very good effects, which would, however, be at least partially offset by some bad effects. If a large part, or a majority, of the stocks of the carriers were owned by their employees, and by the bankers, manufacturers, merchants, farmers, clerks, etc., along their lines, it would be much more difficult than it is now for walking delegates, demagogues and reckless newspapers to cause unjustifiable and ruinous strikes and reductions in rates. The employee would then think of his railroad dividends as well as of his wages, the shipper would then think of his railroad dividends as well as of his rates; in every community there would be men with an incentive to contend for fair treatment for the carriers. In a large part of the country, especially in the South and West, the men who now control, or are regarded as controlling, the railroads, are looked upon as oppressive absentee landlords upon whom employees and public are justified in making reprisals at every time and in every way that they can. A fair public sentiment would assure to railroad corporations the opportunity to earn a profit equal to what may be earned in other large and well managed businesses, thereby fostering that development of the country's transportation system which is necessary to enable it satisfactorily and economically to handle the country's commerce.

There are some ways, however, in which the thorough "peopleization" of the railroads probably would tend to diminish their technical and economic efficiency. It is probably essential to the permanently successful management of a large modern industrial or transportation concern that it shall have at its head a man, or at most a very few men, of eminent business capacity, who shall be given an autocratic power over the management of the business, tempered only by the requirement of accountings at stated intervals to the owners, and, perhaps, to the public. The modern corporation and the modern money market have been potent agencies in promoting industrial development mainly because they have made it possible for men of great ability, but perhaps of comparatively small individual means, to secure the direction of large aggregations of capital formed by the combination of the relatively small means of numerous persons having capital to invest in corporations with the small means of the still more numerous persons having capital to loan to corporations either indirectly, by putting money in the banks, or directly by buying their bonds. Suppose now, that all those who at present are directly

or indirectly creditors of railroads should begin to withdraw their loans and to invest their capital in railroad stocks, and that this process should go on until the "peopleization" of the railroads was complete. Would the result be more or less honest, more or less efficient management?

The large mutual life insurance companies were quite completely "peopleized"; but that did not keep their managements from growing scandalously extravagant and corrupt. And even if the stockholders of each "peopleized" railroad took an active and effective interest in its business, would the tendency be to promote efficiency? It is well known that a great majority of co-operative concerns in this country have failed because those owning them could not be induced to pay their managers enough to get and keep capable men. It is well known that in politics the candidates of popular qualities too often win over the candidates of ability. The men who demonstrate the greatest ability in business are often most lacking in popular qualities. Take, for example, the most conspicuous figure in the railroad world to-day. Mr. Harriman has great faults; he has made great mistakes; but he has done a great work for the development of transportation efficiency during the past ten years. He has taken railroads that were bankrupt financially and moribund physically and has made them among the most prosperous and efficient agencies of transportation in the world. He has done this because his mind is always open to new ideas and because he has a genius for commanding the confidence of other men of large business ability and large capital, for initiating new methods and novel and extensive improvements, and for selecting lieutenants of the first order of ability to carry out his plans. Would Mr. Harriman have been able to do the work that he has done as a railroad developer if the various railroads that he has dominated had been thoroughly "peopleized"? It is very doubtful. Certain it is that the public now entirely misunderstands him and regards him as merely a Wall street speculator, overlooking or forgetting the splendid work that he has been doing for years thousands of miles from Wall street.

But while centralization of autocratic control of large concerns in the ablest hands tends to promote industrial efficiency it has been attended in this country by the rise of abuses of corporate management that would be likely to prove as harmful as industrial inefficiency, if not abated. If the nation had to choose between railroad management that was able but unscrupulous, and railroad management that was honest but inefficient, it would probably come out better with the honest management in the run of years. But it does not have to make any such choice. Railroad managements can be honest without being inefficient, efficient without being unmitigatedly autocratic. A wider diffusion of ownership of railroad stock, not among all classes of the people, but among those classes of business men in every community who have enough intelligence and experience to distinguish fit from unfit managers, and to know that the successful conduct of large affairs requires that those conducting them shall be given a very free hand; a more faithful performance by stockholders and directors of their duty of seeing that the managers of their properties do their work honestly, efficiently and with a due regard for the susceptibilities and rights of investors and of the public; a public sentiment and public officials that will seek out the individual railroad men that do wrong and punish them, and not inflict upon all railroad men odium for the offenses of a few; governmental regulation that will discriminate between railroad combinations that are reasonable and beneficial and those that are unreasonable and harmful, and that will let railroads earn profits that will encourage more general investment in their securities—by these means, and probably by no means less comprehensive, will the management of American railroads be made uniformly honest and efficient. "Peopleization" of the corporations will no more solve the various problems presented by the development of modern industry than democracy has solved all the political problems than have troubled mankind.

THE TRAINING OF ENGINEERS IN FRANCE.

Two Austrian engineers, Anton Braun and Franz Garstner, themselves both educated in the French School of Bridges and Highways, as many Austrians have been, especially after the purchase of the State Railroads by French capitalists more than fifty years ago, have contributed to the *Journal* of the German Railroad Union an article on this subject, suggested by one in *Engineering* on the same subject, which they found seriously in error. The error is chiefly in describing the famous French "Polytechnic School" as the great engineering school of France, it being, in fact, at present, simply the preparatory school for the other state engineering schools. It was established by Napoleon I. in 1794 to train engineer and artillery officers for the army, for which purpose it still serves. Its world-wide reputation is chiefly due to the fact that its pupils are a select corps. Every year in several of the chief towns of France a competitive examination is held of such graduates of the lycees (bachelors of science or of arts) as present themselves as candidates for the Polytechnic School. These graduates of the lycees have something more than the education of our high schools and something less than that of our colleges. The examination for the Polytechnic School is especially severe in pure and applied mathematics. Every year something more than 2,000 candidates submit to the examination, and only 200 to 250 pass.

The pupils of this school live in barracks and are subject to strict military discipline, very much like our cadets at West Point, from which they differ, however, in the capital fact that they have all been selected by competitive examinations, and not to pay the political debts of members of Congress.

After two years in this school, the pupils, according to their standing, are permitted to choose their special professional training, in the following schools: Bridges and Highways, Ordnance (application of powder and saltpeter), Colonies, Post and Telegraphs. All the others go either to the St. Cyr Military School or to the Naval School, to be trained as army or navy officers. About four-fifths of the graduates of the Polytechnic School go into the army and navy; the remainder, 40 to 50, in the civil service. They are bound to serve the state for at least five years after graduating from their special school, having been educated free of charge and paid while at school, like cadets at West Point and Annapolis. The men who do not enter the military service and stand highest in rank choose chiefly the two engineering schools—Bridges and Highways, which is particularly a civil engineering school, and Mines, which in spite of its name, trains largely in mechanical engineering, both having been established before the days of railroads. The course lasts three years; for foreigners not graduates of the Polytechnic School, four years. The school year is from November to June, but every pupil is assigned during vacation to some practising state engineer, and required to study the work he has in charge and to report upon it. The two graduates of the School of Bridges and Highways highest in rank are sent abroad for a year and the first one serves a year as Secretary of the Council of Bridges and Highways, where all current state engineering matters pass under his eyes. In the later course of their career these state officers are likely to be engaged by railroad companies or other private enterprises, the state giving leave of absence for such purposes. The whole number of students in the School of Bridges and Highways is only about 60, and the number graduated yearly about 20. The graduates are almost exclusively employed in directing engineering operations, and are highly regarded by the public. There have been cabinets in which three or four engineers were ministers at once. The execution of engineering works under their direction is entrusted chiefly to what are called "conductors" of bridges and highways, not technically educated, and to graduates of the School of Arts and Trades, and of technical high schools.

"Surveying, drawing, the direct supervision of construction, technical computations, and similar matters, an Engineer of Bridges and Highways never does himself."

THE BETTERMENT OF STATE RAILROAD COMMISSIONS.

Mr. Huebner, in his taskful and exhaustive review of railroad regulation by the states during the last five years,* has set forth as perhaps the most prominent fact an increase practically of 50 per cent. in the number of state railroad commissions during that period. Out of the 46 states in the Union only seven have no railroad commissions; and the large increase numerically during the five years has been accompanied by a decided expansion of the reach and powers of the commissions already existing. When one parallels with such facts the increasing scope of the work of the Interstate Commerce Commission and a certain obscuration of the lines between intrastate and interstate business, suggestive, not to say ominous, shadows are cast ahead. As both state and federal authority focalized acutely on the railroads? But that where are they to intersect? When they do intersect sharply will they clash or will they harmonize, will one or the other dominate, and may we not have in a future not necessarily far remote the endless historical controversies of state with federal authority focalized acutely on the railroads? But that branch of the subject remains somewhat academic and speculative, though much less so now than it was a few years ago. Meanwhile the question of the betterment of the system of state railroad commissions, so swiftly growing both in extent and in powers, becomes more and more imperative.

Certain upward tendencies in the commissions are to be noted and to be emphasized the more as they have synchronized with a period of rash and, in certain states, almost frenzied anti-corporation law-making. There is a drift toward uniformity of accounts. The old single-headed commission is giving place to commissions of three or more. This decreases personal responsibility and sometimes lets it be dodged; but it is a necessity of a situation in which not only are intrastate railroad questions becoming more complex, but the commissions are being loaded—perhaps overmuch—with interests added to those of the steam roads. Higher salaries and longer periods of office holding also look in the direction of uplift. So, on the whole, does the decline of the elective plan and the increase of the appointive plan, though the latter rests vitally on the character of the appointive power. But an appointive governor is more responsible than caucus or convention, his eye more discriminative than that of the partisan voter, and, averaging him, he is likely to be less under the sway of demagogic impulse than the elector, even while a governor is over-prone to reward his political friends. Finally, as Mr. Huebner has pointed out, it is better to have commissions with large powers—particularly if subject to judicial appeal—than to have the railroads subject to dogmatic and half-baked legislation. Such legislation is, of course, subject always to the final review of the higher courts, and is having its repeated and hard judicial knocks. But the legal path is slow, devious and uncertain, and a continuous commission is more amenable to reason and mechanically better adapted to it than an intermittent legislature that sits annually or biennially.

All these signs are encouraging as far as they go, but, as yet, they leave the pith of the trouble with the state commissions, in their aggregate, untouched. The political and personal flaw is still there. Let us take an actual example: From time to time in past years we have had occasion to criticize severally the personnel and official lapses of the Connecticut railroad commission. Though it does not fix rates, it is legally a "strong" commission; that is to say, it has had large powers had it chosen to exercise them. But its three members all belong to one political party. One of them is a

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civil engineer some 73 years old, the other two, untrained in railroad affairs, have been ultra-active in politics and the lobby. The official heads of the two last are at stake in a hot contest within the dominant party now being waged for the governorship. Is it any wonder that the history of such a commission has been marked by a tremendous outpouring of water in the Connecticut trolleys, not only unrebuked by the commission but masked by it; and that, in the contest pending, both men figure as leaders in one of the party factions? If the other faction wins, both will go; but other commissioners like unto them will come in to secure the reward of their services for the successful candidate and as the direct products of "machine" politics. And in how many states, with varying degrees, has the situation been like that in Connecticut—a commonwealth which has had a railroad commission for half a century or so, and, in proportion to size, has had most important and complicated railroad problems to meet and solve.

To the political aspirant, indeed, the place of railroad commissioner has a peculiar and alluring charm. By habit and temperament he is a "good mixer" with men, and his place has a far and wide mixing quality. Its pay is not absolutely munificent, but relatively well paid when a commission is weak either in personnel or by statute. And the divinity that doth hedge about the free pass radiates fresh glamors when conjoined with the observation car and good lunching. Men love the sense of power, and the railroad commissioner is no variant from the common rule when he gets quick access to the sanctum of the big railroad president or summons the same official before the conclave to explain a matter of rates or new capitalization. Nor, if he has fences to mend or seeds to sow that blossom into votes, does the political commissioner undervalue that function of his place that gives free access to every railroad point in his commonwealth. To such an official his position, on the corporation side, spells power, influence, "pull," and some more sinister and profitable forces not altogether unknown. If he veers in the other direction and sights through demagogism a governorship or seat in Congress, his agencies are also at hand. Hence the rough division of a large part of our state railroad commissions into two groups—one that plays to the popular gallery, the other to the corporations, with here and there a commissioner that tries to "straddle" and play to both. The state bodies that peculiarly call for the trained aptitudes, character, independence and moral courage thus, unfortunately, have come to be vested with the strongest lures for the party seeker. A good commission can often make the weakest law effective; an infirm commission can nullify the strongest statute. The "advisory" commission of Massachusetts has owed its high place to one strong head succeeded by another. And, be it said for the encouragement of other efficient commissioners, both those men held their places for many years and then resigned them voluntarily.

In the future of our state railroad commissions, with their rapidly enlarging powers, it is therefore the word "personnel" that must be capitalized. The best hope lies perhaps in that enlargement itself. Is it not possible, even probable, that by the "loading up" of the commissions with duties that blend practical sense with the highest technical knowledge, and when the call sounds clear for special training they will be forced more and more out of the sphere of political mechanics, and with their access of judicial functions gain somewhat of that respect which governors recognize when they appoint judges of courts? If not, then the solution must be left to that uplift of the appointing power itself which, in turn, rests on the revival of active and ardent citizenship. The betterment of the commissions by bettering their personal membership in that case shifts into a civic rather than an economic change and takes its place and turn among a hundred other reforms to which the primary and the ballot box are fundamental.

NEW PUBLICATIONS.

Railway Organization and Working. Edited by Ernest Ritson Dewsnup. University of Chicago Press. 5 x 8 in.; 498 pages. Price, \$2.00.

This is a series of lectures delivered to the railroad classes of the University of Chicago. Each lecture is written by a practical railroad man, in most cases the head of a department on some railroad, and each lecture deals with the department of which the lecturer has charge. The book covers a broad field in a general and non-technical way, its chief value to railroad men being in its description of departments with which they are not already familiar. The lectures differ very much in their value, some of them describing the subject with which they deal clearly and as fully as is possible in the given space. The fault with others is that the lecturer seems to feel that now he has a chance to explain his difficulty and the difficulties of the department. The reader can, of course, get a fair idea of the working of the whole railroad staff by reading all the lectures in the book. The lectures are all of them readable and can be understood by laymen. In the chapter on railroad education, a railroad college is suggested. The following are some of the subjects that are suggested for such a college: Railroad construction, economic theory of railroad location, station returns, handling of traffic and law of carriers. The degree such a college should confer would be "Bachelor of Science in Transportation."

Construction and Maintenance of Railway Roadbed and Track. By Frederick J. Prior. 4½ x 6½ in.; 569 pages; illustrated. Frederick J. Drake & Co., Chicago. Leather, \$2.

In preparing this book Mr. Prior has acted only as compiler and editor, drawing his material from authoritative sources. Where necessary in adapting it to this work, he has rearranged and rewritten the matter. Credit is given where it is due. The book is divided into three sections: construction, maintenance of way, and bridges and buildings. The first part is taken almost entirely from J. R. Stephens' writings and Camp's "Notes on Track." This section is concluded with a chapter on Construction Accounts, and there are appendices giving lists of supplies and equipment for field parties, and track formulae, tables, etc.

Various authorities are quoted in Section II, Maintenance of Way. The compiler has chosen his material with good judgment and arranged it well. In Section III, Bridges and Buildings, no attempt is made to go into the details of bridge construction, although some notes on the construction of wooden trestle bridges are taken from the work of Wolcott C. Foster. There are instructions for bridge inspection and the erection of steel bridges. The portion on Buildings is brief and refers principally to Berg's "Buildings and Structures of American Railroads" and Fritch's "Railway Organization and Working." This section concludes with a chapter on wrecks. There are six appendices at the end of the book, devoted respectively to tables, definitions, concrete piling, engineering illustrations, construction illustrations and miscellaneous illustrations.

The Principal Species of Wood—Their Characteristic Properties. Second edition, revised and enlarged. By C. H. Snow, Dean of the School of Applied Science, New York University. 211 pages; 6¾ x 10 in. Published by John Wiley & Sons. Price, \$3.50.

When the first edition of Professor Snow's book appeared it was rightly considered the most valuable addition to the interesting study of tree life and the qualities of wood. But in the interval between that first issue and the present time, Romeyn B. Hough's wonderful hand-book of North American trees appeared, and, although Professor Snow refers to this in his bibliography, nevertheless he failed to see that his work was cut out for him in his second edition. Although both authors treat the subject along the same general plan, nevertheless Hough's treatment, both in his text and in his illustrations, is complete and orderly for all important North American trees; while Professor Snow's treatment, while in specific instances accurate and complete, as to most timber trees it is haphazard and not thorough. It is hard to say

these things of an undertaking involving such an immense amount of labor by an earnest student. There is, however, this one excuse: Professor Snow's book has material in it of high value, and it is comparatively low priced. Something over 100 trees are described, and there are 37 page illustrations. These illustrations are meagre for two reasons. As a rule, only one species from each family is shown. This would enable us, if it were properly done, to get from the illustrations an idea of the structure of the wood, of the bark, the leaf and the fruit of only one of the oaks, the ashes, the elms, beeches, pines, spruces or hemlocks. But there is only a landscape view and a radial section of the wood of the white oak (*quercus alba*), and there is no nearby view of the bark of the tree or of the other two important sections of the wood. The other oaks are not shown and the text descriptions of them are incomplete. For example, under red oak the only use mentioned is "bark used in tanning." This incompleteness is generally characteristic of the treatment of all of the broad-leaf trees. Nevertheless, when the reader comes to the needle leaf trees, especially the pines and the spruces, hopeful of the author's zeal and enthusiasm, he finds only a distant and meaningless view of the white pine (*pinus strobus*). No other characteristics of this model of dignity and beauty, this wonderfully valuable native tree, are shown. Of the spruces, the mark, structure and habit of the black spruce (*picea nigra*) and the Douglas spruce (*pseudotsuga taxifolia*) are shown; but it is hard to imagine why the author omits any illustration whatever of the commercially most important tree in America, the red spruce (*picea rubens*). There is no illustration showing either its habit or its wood structure. There are only eight lines of text concerning this most money-earning tree in North America. In the text description of the black spruce, the use of the wood is given as follows: "Resin is used as a confection." This should give an added interest in this tie timber to the engineers and roadmasters who are using it.

Letters to the Editor.

RATE READJUSTMENT IN THE WEST.

Tucson, Ariz., July 29, 1908.

TO THE EDITOR OF THE RAILROAD AGE GAZETTE:

I had almost said, "Rate Readjustment on the Frontier," but there is no longer any frontier. By the West is to be understood New Mexico and Arizona, Western Colorado, Utah, Nevada, the western part of the Dakotas and Nebraska, Wyoming, Montana, Idaho, the eastern half of Oregon and Washington. North of the Canadian border it includes a strip of territory probably somewhat wider and not quite so clearly defined. The Anglo-Saxon prevails there, and the same economic changes are in progress.

South of the Mexican border it will include practically all of the state of Sonora, Western Chihuahua and the hinterland of the west coast that is now rapidly being connected by rail with the commercial centers of the United States, from which it is to draw its manufactured supplies and where it will dispose of its products. This section, too, must be included for, in spite of unfamiliar conditions and customs, and in spite of laws and language that are Spanish, the dominating idea is Anglo-Saxon, and it is the American farmer and the American miner that are giving impetus to its development. It is to some extent the stress of economic conditions in the United States that is driving them southward and they are one with us in the economic problems to be solved.

On the frontier high prices have always prevailed and the reasons therefor are not hard to discover. Aside from the inflation due to boom tendencies, in some lines of business other than the transportation industry the density of traffic has not been sufficient to justify lower prices.

The part played by the cost of transportation in frontier

high prices has been grossly and unfairly exaggerated. The means of transportation have been varied and at times unique, ranging from the pack horse that picked its way up the eastern slopes of the Alleghanies to the automobile that is a familiar sight in the remotest mining camps of Nevada. Where it was a case of pack mules crossing stretches of desert or the small canoe threading the headwaters of remote mountain streams, the cost of transportation became an item to be reckoned with. In moving heavy machinery and supplies on burro back or even by Mexican and Indian *cargadores* over mountain ranges the high cost has been more apparent than real.

Never in all the history of the West and of the frontier rail lines have the people for long had just cause for general complaint of excessive freight rates. Studied in the light of sound economic principle applied to existing conditions, their reasonableness is at once evident. High prices have been due to other causes, but the jobbers and the retailers have continually thrown dust in the eyes of the people and the railroads have had to bear the odium of the high cost of living.

Careful study will doubtless reveal more than one cause contributing to the rapid increase of prices during the past fifteen years, and the present high cost of living. The chief reason seems to me to be the rapid increase in the production of gold and the consequent decrease in the purchasing power of that metal. That there is going to be no diminution in the gold output seems absolutely certain. We may, therefore, expect a still further increase in the cost of living.

For forty years the cost of transportation in the United States has steadily declined, while the efficiency of the service rendered has increased in a corresponding degree. We give better service for less money than any other country. The decline in rates has reached its limit and an upward tendency is perceptible. If the demand of shippers for an even more efficient service is to be met, the upward tendency must continue with some acceleration. Lowering wages will not bring it about. In spite of some recent just criticisms to the contrary, the standard of efficiency among the rank and file of American railroad employees is unequaled in any other part of the world. Any lowering of the present standard of wages, under existing conditions of increasing cost of living, cannot fail to be harmful. Its reaction would be felt most keenly by those interests that demand still further reductions of rates at the expense of the wage scale.

Such is the situation now confronting the whole country, while the West has complications peculiarly its own. There is no fair-minded traffic man acquainted with the situation but that admits that there are certain anomalies in western rates. These can and will be properly adjusted, but instances of the need of such adjustment are fewer than is generally believed.

During the past fifteen years the present West has been waiting for its cost of living to decrease just as the cost of living has always done on the frontier. Relatively the decrease has come, but it has come by a rapid increase in the East, while prices have remained practically stationary in the West.

The final equalization between the East and the West is at hand and is even now beginning to be worked out. It must be brought about not by lowering western rates to the level of those prevailing in the East. With some slight reduction here and there, the rates in effect in the West should remain where they are, and eastern rates brought to their level. This will be following the course of the prices of other commodities.

It behooves those traffic officials to whose judgment is confided the adjustment and equalization of western freight rates to proceed at the present time with more than usual caution. In their hands rests the revenues of their respective roads and the consequent prosperity of the communities served by them. If they yield to the present clamor it will take

years to repair their mistake. We believe, however, that they will not be found wanting in ability and strength to act conscientiously and to decide for what will ultimately result to the best advantage of the West and of the whole country.

G. C. WHITE.

UNPOPULARITY, AND THE CURE FOR IT.

Chicago, Aug. 12, 1908.

TO THE EDITOR OF THE RAILROAD AGE GAZETTE:

Like all influences of a far reaching extent, the hostility to railroads is essentially of country extraction. The village merchant, the farmer and the hired man have begun to give expression to what has long laid voiceless, and the sun-cured statesman is their willing megaphone—all the more resonant because no longer choked with passes. Like other movements of deep public hostility, it is the result of accumulated petty wrongs and misunderstandings, many so small that railroad managers do not seem aware of them or regard them too trivial for recognition. Some of these wrongs may be imaginary or of a kind for which the railroads should not be regarded responsible, but they are none the less real to those whose memories cherish them. The rural mind has little to divert it from its groove of thought, and some prejudices, like politics, are handed down from father to son. The prejudice against railroads is one of that kind. Strongest throughout the granger states and west, it had its inception years ago. It is not difficult to imagine that in those by-gone days, in early summer, an engineering party on a preliminary survey without "by your leave" waded through the growing grain and returned jibes and jeers to the old farmer's angry protests. Later, the right-of-way man showed up to cajole, browbeat and condemn through the right-of-way. With no thought for the feeling that his actions might leave for the railroad, when built, to combat, this gentleman very probably did not hesitate to resort to methods that would not stand the touchstone test of golden rule ethics. When building was under way, it is not unlikely that the graders burned some of the fence rails—possibly in the hours of the night visited the hen-roost, and that that ever-present nuisance of construction, the impecunious sub-contractor, departed without settling for the last load of hay, or the last dressed hog he bought. For a long time to come all this will be held up against the "railroad," and no credit given for the fact that since the railroad was built the farmer's land has increased in value 50 or a 100 per cent. As years go by, this feeling has been augmented in various ways. Discriminatory rates—real or supposed—both as to persons and localities, have added to the ire. The country passenger reads in newspapers, magazines and advertising matter glowing descriptions of magnificent trains on which you can ride extended distances at remarkably low rates, and when he makes a trip to the county seat, or up the line, at the regular local rate, he reflects that he is being charged more than his share to ride in a dilapidated car, perhaps extremely dirty, with a window or two broken, the roof leaking, more than likely the lamps smoking and dripping oil, the contents of the water cooler slimy, and the closets filthy. If to this is added the discomfort of a wait at the starting point of a half hour or more on account of the train being late and the probability of a miss of connections at the "junction," he will doubtless repeat to the bystanders what Jay Gould said about the people being damned and regard himself the abused victim of "railroad corporation" greed and cussedness. Made eloquent by the exhilarating influence of imaginary martyrdom, he will remind his listeners that the trains are always late; and the probabilities are that he is often right about this, as it is a notorious fact that many railroads have fallen into a habit of scheduling trains at a speed which neither their track nor motive power will admit of, excepting under the most favorable conditions. If traffic officials, more particularly in the west and south, where operating capacity is necessarily less advanced than on the older

roads in the north and east, appreciated that in the long run a schedule which earns for the road a reputation that its trains are never on time is less desirable than a slower but surer schedule, much of the dissatisfaction which railroads now have to combat would have been avoided. To hurry to a station only to find the train marked up late, and perhaps stand around an hour or more waiting for it, robs the busy country merchant or farmer of his time, and is not conducive to a friendly spirit. If in addition, station attaches answer inquirers with indifference or contempt, the feeling will not be improved. A "lying" folder is no more to be commended than any other mendacious publication, and brings its authors and abettors into disrepute and lack of standing. Also, when considering putting on a "train de luxe" it would be well for traffic managers to reflect if such trains do not afford too great a contrast to those trains patronized by the local traveler who usually pays a relatively higher rate, and who will elect the members of the legislature which may prescribe a maximum local rate. There is reason to believe that in some quarters a two-cent passage rate was the obtainable alternative of an unobtainable three-cent local service.

Petty overcharges on freight, pilfering and slight but annoying damages to shipments have added to the grievances of the country merchant or farmer. It is abhorrent to his thrifty mind to see, when the local pulls in, his brightly painted harrows, cultivators and seeders chucked in a heap regardless of scratched paint, dented tin hoppers, or bent parts, his milk cans kicked out of the baggage car into the mud, the rollers knocked off of his new three dollar trunk as it hits the platform, and it hurts his pride to have his remonstrances met by some profanely opprobrious remark concerning "hay seeds." If, later, when he wants to pay the charges, the agent sits ensconced in his office, oblivious to the hammering on door and window, the irritation grows.

The personal injury railroad claim agent also is by the people associated with an evil reputation. This individual too often prescribes his duties with greater zeal than discretion, and by hovering around the maimed and dying has finally got himself looked upon as a sort of ghoul. It is extremely doubtful if the plea that prompt and active measures are required to later prevent mulcting for damages can offset the revulsion of feeling engendered by indecent haste or persistency in obtaining releases and statements covering accidents. It is a well known fact that claim agents often pay considerable sums to people whose demands are wholly prompted by the insistence for a release. A change of time-honored policy with reference to personal injury claims might prove rather expensive until railroads can convince the public that equity and justice rather than force will determine settlement, but there can be no doubt that such a change would ultimately prove profitable to the railroads.

It has been the belief of the majority of the public that railroad corporations have exercised an undue political influence, and this belief has become so general that any man in public life who has protested against the recent anti-railroad legislation has been promptly branded by his constituents as a corporation tool if not a bribe taker. The well-known action of railroads in supplying public officials with free transportation, and perhaps maintaining lobbies, has had much to do with this sentiment, and until railroad legal departments are organized for legitimate legal purposes rather than for political wire pulling the sentiment will not change in favor of railroads. The interests of the railroads, as well as the welfare of the public which they serve, are too great to allow of railroads failing to take cognizance of public measures affecting those interests, but their political activities should be directed toward enlightening the public mind and the voter instead of swaying the legislator. There are many ways in which this can be done, provided it is done frankly, openly, and in a manner that commands the public confidence. Long-winded sophistries, fallacious comparisons, and befogged

statements will not serve the purpose. Every large railroad issues a folder which is reissued monthly and widely distributed among its patrons and others. If a limited amount of space, say a single page, was devoted to succinct statements bearing on cost of construction and operation, scrupulously correct as to fact, and in order to have due weight, over the signature of a responsible officer, preferably the president, many erroneous impressions now prevailing would be corrected. Few people have any but the haziest ideas as to the cost of even the tangible part of a railroad. If the passenger taking a Chicago outbound train knew the number of millions of dollars invested in real estate, track elevation, viaducts, etc., making it possible to haul him to the city limits with safety, he would probably feel that the fare paid by him was after all reasonable. With some exceptions, a wider knowledge of the cost of its property, the expenses of its permanent way and trains, the extent of its payrolls, etc., would be a benefit to every railroad, and it would be well for railroads to place, in an unobstructive way, the information before their patrons and employees. The latter should be a power in the dissemination of correct information among the public, but to realize the benefit of that power requires that the employee should know and know correctly. Not long ago the writer overheard a traffic officer in a responsible position solemnly state in general conversation among a group of men that the large passenger engines recently placed in service by his road cost \$100,000 each! Not only through its folders, but by utilizing the backs of its expense bills or other documents which reach the public, the railroads might at no great expense do much to correct certain wrong views concerning railroads. It is useless to trust to stereotyped country paper editorials, subsidized country attorneys and lobbyists, or the reports of the Interstate Commerce Commission and state commissions which reach only the railroad official, the student and the politician.

For years much has been said concerning capitalization. On the one hand the anti-railroad politician and the probably honest but uninformed proletarian have vociferated loudly of over-capitalization, while on the other the railroad apologist has learnedly pointed out that capitalization in America is less than in England, etc., both arguments being about equally to the point. As a matter of fact, some of our railroads are over-capitalized and others are under-capitalized. More often, the present value has no relation to, and furnishes no data to determine, the justness of the present capitalization. What was the original Southern Pacific may to-day be worth every cent of its capitalization, still it is a matter of official record that the bankers' syndicate which financed the road received \$40,000,000 in stocks and bonds while the actual cost of construction and equipment was \$6,500,000. From the standpoint of the public, other than the investor, the evils of over-capitalization are no greater than the evils of under-capitalization—in the former instance, theoretically the rates charged the public should pay interest on an excessive principal, while in the latter case the rates have actually provided the principal itself. As a matter of fact, it is extremely doubtful whether the masses whose sentiments have found expression in anti-railroad legislation care a rap about capitalization one way or the other, or know the subject further than as a catchword useful in giving voice to anti-railroad feelings. He who is too often underestimated as the untutored haypitcher knows that men prominent as railroad builders and whose names appear frequently in the family paper as captains in the railroad world, have amassed large fortunes, and that they did not acquire them by growing alfalfa or raising hogs. Incidentally, the said haypitcher infers that the fortunes have been squeezed by the railroads out of the people. Unfortunately, there are many incidents in the history of railroad construction and finance that make such inference not unnatural. What Mr. McCullough, a noted economist, in his Supplementary Dissertations to Adam Smith's *Wealth of Nations*

said nearly 50 years ago concerning the railroads in England, viz.: "The construction of railroads has occasioned, or at all events has been accompanied, with an amount of gambling, fraud and embezzlement, unparalleled in the annals of industry, and highly disgraceful to the national character. No doubt, however, these odious practices * * * will be eventually put down, and when this desirable consummation has been effected, the country will enjoy the advantages of the railroad system without the corruption and villainy with which it has been so largely alloyed," may find ready application to certain periods of railroading in America. It is easier to justify the present ethical position of railroads than to substantiate a past record of rectitude. To inspire public confidence by placing before the public the information which indicates that railroads are at *present* operated with a just regard to fair dealing and a full appreciation of their obligations to the public should be the aim of every man employed in the railroad service. The facts are such that diligent effort in that direction will bear fruit.

Legislative action should not be combatted just because it is legislative action. Railroads have with justice opposed the two-cent fare laws enacted in various states within the past year. Considering, however, the rate of \$6.25 per capita for parties of ten between Chicago and the Missouri river, and \$10 from Chicago to New York, both yielding but little in excess of one cent per mile, voluntarily placed in effect by railroads at a recent date, it is not surprising that the public should question the grounds on which the two-cent rate enactments are opposed. It also suggests the thought that traffic men have not fully outgrown the inclinations which in the days of Albert Fink earned for them the appellation of "irresponsible." Consistency as well as fairness will do much toward establishing confidence and respect in the public mind.

To one who has for the last two decades followed railroading as an occupation, and who has been at all observant, two things must have frequently invited his attention—one the multiplicity, and constantly increasing number, of rules, the other the lack of observance and increased contempt for rules among employees. This has resulted in a condition where many rules affecting the relations between carrier and patron are invoked only when the personal interest, feeling or caprice of the employee elects. As an example might be cited the excess fare rules of many railroads which while mandatory on the face are tacitly ignored excepting in cases where the conductor feels like demanding the excess and the passenger good naturedly pays. Many other rules indifferently enforced are a source of annoyance to the public and of no substantial benefit to the carrier. The fact of the matter is that, following the bent of human inclination to "regulate" things, operating, traffic and other officials often make rules about trivial matters prompted by the annoyance of some concrete case that may not find its analogy for years, until the station and train employees are in the midst of such a deluge of "musts," "don'ts," "regulations," "conditions," "modifications" and "exceptions" that they are somewhat calloused to all. In so far as rules are not in connection with matters affecting the public, the railroad suffers only through the time and stationery wasted in issuing the rules, and the bad effect such a condition has on discipline, but with reference to unwarranted rules affecting the public, additional harm accrues through the discrimination, irritation and dissatisfaction of the patrons, engendered by intermittent enforcement. If the president of every great railroad would retire unto himself for a few weeks, disengage his mind entirely from its railroad connection, have brought before him all of the rules of his company, whether in classification, tariff, book or circular, review them judicially—bearing in mind that as a railroad is dependent on the good will of its patrons for its prosperity every rule in any way objectionable to the public and not necessary, just and of substantial benefit to the railroad should be eliminated—the result would be a tremendous diminishing

of rules, better discipline among employees, and a better feeling of the public toward railroads.

The active anti-railroad agitation of the last year or two will doubtless be followed by a reaction, but the accumulated prejudices of years cannot be overcome in a few months or years, and to establish a relationship of fairness and good will between the railroads and the people will require at the hands of the former the widest possible publicity of railroad affairs, and the rendering of faithful, efficient and impartial service. Such a policy, if consistently followed, will in course of time beget confidence on the part of the people, and result in greater freedom of action, on legitimate lines, for railroads.

A. HERMANY,

Auditor, Passenger Traffic, Chicago, Rock Island & Pacific.

ECONOMICAL CARE OF MATERIAL.

Ottawa, Ont., August 14, 1908.

TO THE EDITOR OF THE RAILROAD AGE GAZETTE:

The article under the above heading in the *Railroad Age Gazette* of July 24 is interesting, but not instructive, and was certainly not written by a man who has practical knowledge of handling railroad supplies.

Theory is good at times, but practice is always better. I remember an experience I had some years ago on railroad construction in connection with the boarding of men. Our camps consisted of boarding, cooks', dining and sleeping cars. Each dining car seated thirty men, and the men were charged 15 cents for each meal eaten. Every meal missed for any reason was not charged for, and it was up to me to keep an account of these that could not be disputed by any of the 150 men in each of the camps, and to do this at the least possible cost. This may look like a perfectly easy and safe proposition, but to understand it a few things must be kept in mind. In the first place, 90 per cent. of the men were constantly figuring out schemes whereby they could beat the company out of a meal, and there was only one waiter for each car of 30 men, who changed constantly from one car to another, so that the waiter could not by any possibility check up his own car, while the cooks during meal hour could not leave the kitchen car for a moment, and the eating men were in a line 180 ft. long, with only 30 of the 150 under the eye from any one point. Furthermore, 18 minutes was the average time these men remained at table, and they would cut this down to 10 or 12 minutes at any time if they saw a prospect of getting away without being checked for the meal, so that we had about 10 minutes to go down the line and get each man's number—each man being carried on pay rolls both by name and number.

The plan I evolved was a perfectly simple one. Each man was entered by name and number in a cheap, fool's-cap-size time book, ruled off into small squares for each day of the month, and as soon as the men were seated a clerk started at one end and went from car to car with this book in his hand, checking with a mark in the proper square thus ✓, each man as he gives his number; the marks standing, first, breakfast; second, dinner; and bottom, supper. On arrival at the end of the line a glance at the book would show a blank for any man not checked, and he was at once looked up, or if a man gave a wrong number, as they did at times, it was caught in the duplicate check and the attempt at fraud was severely punished.

This simple little scheme worked out so perfectly that I could tell each and every one of our hundreds of men just what meal he missed on any day in the month, and in actual practice our troubles in this respect were reduced to the minimum. But as the men could not beat us at one end they had a try at the other, and as each discharged man called at the head office for his pay he registered a kick for an over-charge for board. Unfortunately for us there was a gentleman in that office who was somewhat short on practice, but

very long on theory, and without going further into the matter than the depths of his own mind he evolved a scheme that was to make us all happy, and it was this: He had a weekly meal ticket printed, with the center for name and number, and figures around the edge to be punched out, one for each meal. There was nothing original about it; they are used in cheap eating houses in every city. I was to make these out in duplicate for all these hundreds of men each week, give the men one copy and hold the other. Then at each meal the clerk was to go through the car with 150 tickets, punch each man's ticket, then the duplicate, and there you are.

But can anyone imagine that unfortunate clerk doing this? How long will it take him to stop a hungry man at his dinner, secure his ticket, punch it, then hunt out the duplicate from a bundle of 150, and punch that, and repeat this 150 times in 10 minutes? But even that might be done if the ticket were there to be punched, but these men were navvies; they stuck their tickets in their hip pockets, they sweat, they were out in the rain, and after the first or second day what you got, if you got anything, was a mass of pulp that had been a ticket. The gentleman with the theory always claimed that I was prejudiced against his plans or I would have carried it out and made a success of it, to his glory; and I guess he was partly right—I was prejudiced, very much indeed.

What all practical men want to-day is satisfactory results, and he who points out the shortest and cheapest method of arriving at them acquires merit, but he who advocates the system of the circumlocution office will hardly be listened to with patience.

It is a fact fully recognized to-day by practical people that a poor system well carried out is very much better than a better, or more elaborate system that breaks down in the middle. If railroads were in business to-day for the purpose of keeping a model storehouse, regardless of expense, the plan outlined by your contributor might commend itself to them, but they are not, and so long as the storehouse is big enough and laid out so that each class of supplies may be kept by itself, and all in plain sight, that is all that is required of it. The remainder lies with the man in charge, and the more simple his office methods are the better for himself and the company he works for. And in judging of his ability or fitness for his position, the man who knows will not be moved by the quantity of supplies in sight, how the quantity in a bin, or shelf, agrees with the ticket that is supposed to tell you, but seldom does, or how the ticket agrees with a stock book, but he will look up the following items:

1. How many miles of railroad does the store in question supply?
2. What is the balance brought forward to current month?
3. The amount of the debit for supplies received.
4. What is the total cash value of his issues for same period?
5. The total of his pay roll per month.

And if he finds these figures work out as follows, he knows that there is not much room for improvement:

If the total cash value of balance brought forward is less than \$75 per mile of road supplied.

If the cash value of issues amount to 40 per cent. of balance and debits for the month, and

If amount of pay roll is not more than 1 per cent. of balance and debit, or 2½ per cent. of issues.

It would take up far too much space to take up each paragraph of this article and criticize it fully and intelligently, but I think most people will agree that the plan outlined would be more suitable for a government museum than a railroad supply store. I do not know where the writer gets his ideas of an inventory requiring 60 to 90 days, as most railroad storekeepers get them out in 10 and 12 days, and even without this extraordinary duplication of work know

just about where they stand even without taking an inventory.

There are a few items that seem rather obscure. For instance: "In order to ascertain the average monthly issues it is necessary to adopt a method of identifying the material with the requisition." I can say nothing as to that for the reason that I do not understand it.

Numbers on Department Requisitions.—This is not new, as it is in general use and has been for years, but why complicate it? Of what use are all these duplicates and triplicates? Say we are dealing with the road department; the roadmaster receives requisitions from his foremen, who have their own numbers for reference, and after checking same he compiles general requisition on stores department showing sub-numbers in margin, copies in issue book, and sends it along, holding the foreman's requisition on file with his general requisition number on its face. What more does he want for complete record?

Stores invoices always show requisition numbers, but why made in triplicate? Your correspondent is not clear on that point.

General storekeepers' requisitions generally do have the department number, but again, why duplicate and triplicate?

The system of numbers for classes of, with numbers, names and stamped or stenciled on articles would, as I said before, be all right for a government museum, but we don't buy railroad supplies to place in a museum, we buy them for use, and he who buys and keeps on hand the least quantity is doing the best business for his company.

But your contributor has one good thing to offer, and it should not be lost sight of, even if mixed up with the usual duplication, and that is, that the copy of the purchasing agent's order shall go to the party who makes requisition and who will receive the goods. The importance of this item, I am sorry to say, is not fully recognized by all railroads, but a very little consideration will convince anyone interested in supplies how very important it is. A few of the reasons are: It keeps the storekeeper or person making the requisition fully informed of the progress of his requisition and enables him very often to assist in securing prompt delivery. It makes it possible to check and correct at the proper time mistakes in requisitions and in purchasing office. By being fully informed as to where material is ordered, and when, the party requiring it can make his plans so as to avoid delays and often loss of time by men, which means loss of money to the company, and it gives the storekeeper just the information he requires for entering up the only stock book that has ever been of actual value in a railroad store. It also saves letter writing by persons making requisitions, and the looking up of records and replies by the purchasing agent's office. In fact, it is one case where a duplication in the form of a carbon copy saves many others, and is about the only duplication that is justified.

With this copy of order entered in a stock book that has on the same page room for entry of invoice when goods are received, you have a record of purchase and receipt, with price and all particulars, so that you can tell in a minute what quantity of any class of material you have received during any period of month or years, and with this as a foundation and the remainder of your office system arranged to suit your own road's local and general requirements, keeping always in view the non-duplication and simplifying of work—and with a man in charge who is familiar with the 4,350 items of railroad supplies, you should, and can, come very near reaching the maximum of efficiency.

ERNEST J. M'VEIGH,
Storekeeper, Grand Trunk Ry.

The project for enlarging the capacity of the Siberian Railroad, towards which the Duma has appropriated more than \$18,000,000, includes not only a second track from Omsk, which is 495 miles from the western end of the road, to Karymskaya, where the branch connecting with the Chinese Eastern di-

verges, a distance of 2,042 miles, but a reconstruction of the 780 miles through hilly country west of Irkutsk, reducing grades and curves, and the construction of 42 passing sidings on this section of the line. The Committee on National Defense urged that this work be completed before 1911; that the maximum grade be not more than 1 per cent., and that as the Lake Baikal ferry has proved a failure in winter, a second track be laid around the south end of the lake, which will be an enormously costly undertaking.

COOLING AND VENTILATING THE NEW YORK SUBWAY

The attached report was made by Bion J. Arnold to the New York Public Service Commission. (See also *Railroad Age Gazette*, July 10 and July 3.)

Except at infrequent periods of sudden rise of temperature in the street, the temperature of the air in the subway is at all times higher than that of the street air. In the winter the higher temperature is not objectionable, in fact the warmer air in the subway may then be considered an advantage, but in the summer the excessive temperature is a decided inconvenience.

This heated subway air, acting as a carrier for the fine particles of black, metallic, adhering dust and oily odors creates an impression upon the passenger that the air is impure, while the appearance of the ballast along the tracks, and the accumulation of dust and dirt in the corners and along the side walls suggest an unsanitary condition which, although seemingly dangerous to the health of the passengers, is not necessarily so.

When the subway was originally built, no special provision was made for the disposal of its accumulative heat or for its positive ventilation. Consequently during the first summer (1905) of its operation there were many complaints of the excessive heat and of the insufficient ventilation, which resulted in investigations being made as to these defects.

Dr. George A. Soper made a report to the Rapid Transit Board in February, 1906, which covered very thoroughly his study made in the summer of 1905, of the temperature and the humidity of the air, its chemical and bacterial conditions, the dirt and odors in the subway, and its sanitary care.

The general conclusions from this report were that the subway air, although carrying an unusual amount of dust, was practically as pure as the air in the streets; that the odors, while annoying, were not harmful; that the number of bacteria was less; that the temperature was higher; and that the relative humidity was lower than that of the street air. Dr. Soper severely criticised the lack of sanitary care given to the subway and made a number of valuable recommendations relative thereto, to which I call the attention of the commission.

George S. Rice, chief engineer of the Rapid Transit Board, made an investigation at the same time of the problem of heat disposal and of ventilation, and as a result of his recommendations in March, 1906, grated openings were made in the subway at the stations; 25 exhaust fans in conjunction with 14 ventilating chambers with automatic louvres were installed bordering the subway between 59th street and Fulton street; automatic louvres were placed on the 17 roof ventilating openings in the parkway between 96th street and 59th street, and an experimental air cooling plant was placed at the Brooklyn bridge station. As a result of these extra openings and louvres, it was estimated that there would be a complete air renewal every 27 minutes in the section between 59th street and Fulton street, and when combined with the air discharged by the fans, there would be produced in this section a renewal of the air once in about 10 minutes. In the section between 96th street and 59th street stations it was estimated that there would be an air renewal once every 33 minutes.

PRESENT CONDITION.

The condition of the subway at present as to the purity of its air, the quantities of dust, the prevalent odors, the humidity,

the unfavorable sanitary features and number of bacteria may be considered the same as at the time of Dr. Soper's report, as no change has been made that materially alters these conditions.

Setting aside, therefore, the questions investigated by Dr. Soper, as being the same as in 1905, the remaining fundamental feature for consideration is the heat in the subway, its causes and best ways for its elimination.

While the installation of grated openings at stations and fans and automatic louvres between stations tended to relieve the heated condition and to increase the ventilation of the subway, nevertheless, it is manifest that the subway is still hot, and too hot for comfortable travel during hot weather. The automatic louvres, acting independently, accomplish a change of air about once an hour, the fans, acting independently, accomplish a change of air about three times an hour; but when the fans and louvres are acting jointly the efficiency of the louvres decreases because the discharge of fans, being into the same chamber as that of the louvres, creates a pressure therein against which the louvres have to act when opening. This fact, together with the limited results shown by the louvres, when operating independently, makes it impossible to obtain at present a change of air once every 10 minutes as expected at the time the fans and louvres were installed. The fans are not operated between 7 a. m. and 7 p. m., presumably due to the fact that the discharge of the heated air through the gratings in the sidewalks is objectionable to pedestrians during those hours. The experimental air cooling plant at Brooklyn Bridge produces only a localized cooling effect which, although noticeable to persons waiting at the station, does not extend its effect any great distance into the subway.

The heat of the subway comes from the operation of the trains, due to the fact that about 85 per cent. of the electrical energy produced by the power plant which operates the road is dissipated in the subway in the form of heat. While a small amount of heat is radiated from each passenger, the great part comes from the electrical losses in the motors and resistance on the cars; from the mechanical friction of the brake shoes in stopping the trains; the friction of the bearings and the third rail shoes, as well as from contact of the wheels on the rails. During the summer months about one-fifth of the heat, using the air as a carrier, passes out through the openings along the subway into the street, the other four-fifths tending to escape through the sides and bottom of the subway.

In the sections under the East river and the Harlem river and in the Broadway tunnel north of 145th street, a considerable part of the heat is carried off through the subway walls, but in most of the subway the ability to carry away large quantities of this heat does not exist, as the subway is located so near the street surface that only the two sides and bottom are favorable to thermal flow, and these are restricted for this purpose on account of the waterproofing of the subway and the boiler rooms of the adjacent buildings.

The amount of heat given off by the train operation in 24 hours in the subway between 96th street and Brooklyn bridge approximates the heat liberated from burning directly in the subway two tons of coal at each of the 20 stations in this section, or a total of 40 tons during the 24 hours. A conception of this comparison will give a good idea of the problem for solution if the subway is to be cooled its entire length, and have the same temperature therein as in the street.

METHODS OF COOLING THE SUBWAY.

The most available ways for reducing the temperature of the air of the subway are as follows:

First—Refrigeration.

Second—Cooling by water.

Third—Blocking the automatic louvres open, and providing additional openings.

Fourth—Frequent air changes by means of a center wall and train movement.

An analysis of these methods is as follows:

There are two methods under the first plan:

A—By the rapid expansion of compressed air.

B—By the evaporation of volatile liquids.

Method "A" of delivering air which has been compressed to a considerable extent into the subway and absorbing heat by its rapid expansion where exhausted, is known to be so inefficient as to make it practically impossible of adoption owing to the fact that it takes 55 cu. ft. of free air to absorb one heat unit through a range of one degree Fahrenheit, and there are millions of heat units that must be absorbed.

Aside from the objection to this system, due to the large quantity of frost and moisture created at the points of exhaustion of the air and the very cold temperature spots through which the passengers would be carried at these points, the first cost and operating expenses of the system would be so great as to make its adoption prohibitive.

Method "B," consisting of the evaporation of a volatile liquid for absorbing the heat, adapts itself to different ways for making its cooling effect available. Of all the plans under this method which might be used, that of placing the cooling pipes directly in the subway, as opposed to that of placing them in compartments and forcing the air over these pipes by means of motor-driven fans discharging the cold air in spots into the subway, is the most efficient one to adopt.

To absorb effectively the heat given off by the train operations in the subway between 96th street and Brooklyn bridge would require the cooling effect resulting from the melting of about 3,000 tons of ice each 24-hour day. It would not be practicable to put ice daily into the subway to do this work, because the same cooling effect could be accomplished more economically and satisfactorily by circulation of cooling elements about the subway in pipes from refrigerating plants.

In order to obtain under this direct method the capacity and the effectiveness necessary, there should be a number of plants installed along the route of the subway, preferably at express stations and between the local stations. There is not room in the subway for these plants, so that sufficient space bordering the subway would have to be acquired for the motor-driven refrigerating machinery and tanks, from which tanks the pipes could pass into and about the subway. A good location for these plants would be under the cross streets and contiguous to the subway. In the four-track section between 96th street and Brooklyn bridge plants of 300 tons refrigerating capacity at each express station and plants of 150 tons capacity between each local station would be required. This makes a total capacity of 3,300 tons of refrigeration in this part of the subway, for which it is estimated the total first cost of the 17 plants would be \$1,500,000 with a yearly cost of operation of \$225,000 exclusive of interest and depreciation on the original investment. To cool the remaining heated portions of the subway would require an equal investment and operating expense, making a total original investment of \$3,000,000, and an annual operating expense of \$450,000, exclusive of fixed charges, for reducing the temperature of the subway approximately six degrees below the present average temperature.

The result obtained would not justify these expenditures, especially in view of the fact that other methods hereinafter set forth, while perhaps not as effective, would materially alleviate the present unsatisfactory condition without so great an expense.

Second—Cooling by water.

There are two methods under the second plan:

A—Forcing the air by fans over pipes in which cool water is circulated by pumps.

B—Drawing the air through fine sprays of cool water and forcing this air by fans into the subway.

Method "A," which is now in use at the Brooklyn bridge station, produces a localized zone of cooler air and has shown some benefits, but on account of the large ducts needed for carrying the air, this system could not be used generally

throughout the subway as a cooling factor, although it could be used at the express stations.

Method "B" would require an extensive layout for controlling the air movements, so that all entering air would first come into washing contact with sprays of water and then be forced directly by fans into the subway.

While the temperature can be noticeably reduced by air washing, the resulting increase in the humidity of the air in the subway by such an operation would be excessive and would likely cause much more discomfort than is now experienced under the present conditions.

Both methods "A" and "B," however, are limited to localities where plenty of cool water at reasonable cost is available. Any water to be effective should have a temperature not higher than 65 deg. F., and it is doubtful if a sufficient quantity of water at an economical rate could be obtained along the route of the subway for such purposes.

Neither of the above methods, when their limitations are considered, appears feasible for the work necessary to be performed.

THIRD—BLOCKING AUTOMATIC LOUVRES OPEN AND PROVIDING ADDITIONAL OPENINGS.

The automatic louvres connected with the fourteen ventilating chambers bordering the subway between 59th street and City Hall are so constructed as to prevent any street air passing through them into the subway. They open upon sufficient air pressure being created by an approaching train, and then only to allow the heated air to be discharged. This plan of operation was intended to draw the cooler street air into the subway at stations and to discharge the heated air from the subway through these louvred openings between stations. On account, however, of the conflicting air currents set up by the opposite train movements and the slow speed of the trains in approaching some of these louvres, there often results an absence of the necessary air pressure to open them. As a consequence these louvres are open only about 25 per cent. of the time. Mechanical devices should be arranged to keep these louvres open during the day and to allow them to operate at night, so that the exhaust fans could be used to remove some of the heated air. This should be done. By this arrangement these openings would add an area for free passage of air equal to one-half the area of the present effective station openings, and would allow large quantities of the cooler street air to be drawn into the subway, thus making these openings much more effective than at present.

The keeping of the louvres open and thereby producing "cold spots" in the vicinity of the louvres would not noticeably change the present ventilating system, for the small quantities of air now passing through the louvres do not cause any noticeable influx of air at the stations to take the place of this discharged air. If, on the other hand, these louvres were blocked open there would be an appreciable effect of cooler air upon the passengers when passing these free openings, thus relieving the depressing effect due to the constant temperature now existing between the stations.

The present openings through the kiosks and sidewalk gratings at stations, aside from the louvred openings between the stations, are the only means for the passage of air into and out of the subway. If the roof of the subway were removed for a length of one block, the area uncovered would be about the same as the combined effective areas of the present kiosks, grated and louvred openings into the subway between 96th street and Brooklyn bridge. If the subway had no roof the heated conditions would not exist. It is manifest, therefore, that the present roof openings cannot help matters much unless these openings are either greatly increased or otherwise made more effective. For this reason every effort should be made to get as many openings as practicable from the subway to the street surface wherever such openings can be protected from street traffic.

FOURTH—FREQUENT AIR CHANGES BY MEANS OF A CENTER WALL AND TRAIN MOVEMENT.

The more often fresh, cool air is drawn into the subway and heated air discharged, the lower will be the temperature therein. The subway air averages about 6 deg. hotter during the summer than the street air, although there are some times during the summer when the subway is from 12 to 15 deg. hotter than the outside air.

The subway as built presents no favorable features to promote thermal flow ventilations. In order to obtain this thermal flow there should be considerable difference in elevation between the point of entrance and the point of exit, and also a difference in temperature. While there is a difference in temperature between the street air and the subway air, the openings along the route of the subway are practically on the same level as the roof of the subway, so that the quantity of heated air rising and replaced by the cooler entering air (an action similar to the ordinary fireplace ventilation in dwellings) is practically negligible. In addition to this disadvantage toward thermal flow, there exists the absence of any direct positive continuous full flow of air along the subway, such as occurs in single-track tube construction or in construction in which the train movement is always in the same direction, because now the opposite train movements churn and whip the air, producing opposing pressures and a rotating effect of the air about the train. The result is that most of the air has no definite direction of travel and remains in the subway instead of being discharged from the openings along the route.

This air can be made to travel in the same direction as the trains by constructing a division wall between the tracks upon which trains travel in opposite directions. This division wall would enable each train to push out a large quantity of air as it approaches a free opening and to draw in considerable air as it passes the opening, thus producing what might be termed "piston ventilation." This system operating in the subway would make a change of air therein at least six times per hour during the day, instead of two times per hour as at present, thus noticeably increasing the present ventilation, as well as relieving, to a considerable extent, the heated conditions prevalent during the summer, making the subway more responsive to the outdoor temperature changes and decreasing the power necessary to overcome the air pressure which now exists against the front of the trains, due to the counter currents caused by the rapidly moving trains in opposite directions.

Moreover, the present system of ventilation would be made much more effective. The openings at the stations which now have a slow, uncertain and changeable velocity of air passing through them, would pass greater quantities of air in long extended draughts, making the passengers feel the air movements. The 25 exhaust fans, which can now just about take care of the heat given off by the trains during the night operation, could remove some of the stored heat for which they are well adapted. All of these increased operations would combine to draw cool air into the subway in quantities at least three times as great as at present.

The continuous air movements which are obtained by trains running in tubes or where they travel in the same direction in one space can be shown to exist in the Brooklyn tubes of the subway under the East river; in the section between the Grand Central Station and 33d Street Station; in the Hudson tunnel and sections under Sixth avenue, and in the London tubes. All tubes now being installed under the rivers to Manhattan Island will have this piston ventilation.

DETAILS OF DIVISION WALL.

Between 96th street and Brooklyn bridge this wall for controlling the air movements should be constructed on the center line of columns between the express tracks.

The "H" section plate and angle columns in the subway are well adapted for the construction of a 4-in. terra cotta block wall laid in cement mortar, between the columns. This type of wall would be very strong and would strengthen the present structure. A concrete wall would be satisfactory, but more expensive, and would not serve the purpose for which the wall is installed to any greater advantage. It would, however, be more effective as a guard in case of derailment of trains.

It is essential to have the wall continuous so as to prevent any by-passing or short-circuiting of the air. Between stations it must be left in the rough, but for the sake of appearances in front of the stations it should be smoothed with cement mortar. At stations and wherever necessary, vertical counterweighted sliding doors could be installed to allow passage for employees, and if thought advisable the upper half of the wall at stations could have vertical counterweighted sliding windows for observation at stations.

As the express trains do not run in the early morning hours, this wall could be put in quickly. While it would stop employees working in the subway stepping between center columns to escape the trains, it does not make a dangerous condition, as they could use the space between the local and the express tracks the same as is now done in any place where two-track construction is used.

The cost of a 4-in. terra cotta block wall between 96th street and Brooklyn bridge should not be over \$76,000, or \$2.25 per running foot. The cost of a concrete wall in the same section should not be over \$130,000, or \$3.85 per running foot.

AUXILIARY DISC FANS AT EXPRESS STATIONS.

Should the expense of this division wall prevent its prompt installation it would be advisable to install at an early date large fans at the Grand Central Station and 14th street express stations to draw the air from the street through the kiosks and force it in large quantities and at a moderate but noticeable velocity down upon and among the persons awaiting trains on platforms. Disc fans are advised at these stations instead of blowers with cooling coils and distributing ducts on account of the difficulty of obtaining sufficient cooling water at reasonable cost at these locations.

Since at 72d street the congestion of transfer passengers is not excessive and the 96th street station has many free openings to the street, it does not seem necessary to install fans at these stations, as it is believed that the piston action of the trains will be sufficient at these points.

Four disc fans should be installed at each station at a cost of not over \$5,000 per station.

RECOMMENDATIONS.

In order to decrease the heated condition of the subway and increase its ventilation, the following recommendations are made:

First—Block the present louvres open during the day and allow them to operate at night when the fans are being run.

Second—Construct as many protected openings as practicable between the subway and the street.

Third—At the 14th street and Grand Central stations install large disc fans, located in such a way as to draw air from the street through the kiosks and force this air in large volumes down upon and among the persons waiting for trains upon the platforms.

Fourth—Construct a solid continuous division wall between the downtown and uptown express tracks extending from the north end of 96th street station to and including Brooklyn bridge station.

For the purpose of demonstrating the feasibility of such a wall, it is suggested that the section extending south from the center wall now at 33d street station be constructed first far enough south as to include the 14th street station. At stations the upper half of the wall to have vertically sliding counterweighted windows between columns.

INJURY TO CARS IN DUMPING MACHINES.

In November, 1907, the attention of the Pennsylvania was called to the fact that considerable damage was being done to freight car equipment by the action of car dumpers, in which machines the car is firmly clamped and inverted to allow the lading to run out. Accordingly, a committee was appointed to investigate the matter and to ascertain, if possible, the causes of the damage and to suggest practicable remedies.

The committee visited a number of lake ports and steel works where these unloading machines are located and found that in nearly every case a car, in passing through one of these machines, was damaged to a certain extent. The unloading of 172 cars was witnessed, and of this number 93 per cent. were damaged. Among the machines visited five different makes were found to exist, differing in construction and operation, but, in so far as their effect on cars is concerned, all the machines are practically the same, for they all have two common essential features, namely, the method of clamping the car to the supporting track and the method of protecting the side of the car from the cradle side on which it rests as it turns over.

In every type of dumper these two features are the cause of damage to cars, either because the machine is carelessly handled or faulty in design, or because it is allowed to remain in a state of bad repair. The first is clearly illustrated in the case of machines on which the clamping is done by hydraulic power, a number of cars being bent out of shape simply because the operator did not check the hydraulic power when the clamps were tight.

Faulty design is shown in the weak cradle sides which are bent out of line and thus cause the burden of supporting the load to be thrown on the side of the car instead of on the blocking provided for that purpose. Furthermore, the blocking itself is in many cases at fault, both in arrangement and construction. Many cases were found where the blocking was not only composed entirely or in part of iron where it should have been of wood, but was in addition so arranged as not to give proper support to the side of the car.

Bad repairs were universal. In many instances the blocking was worn down so as to be useless, but was not repaired. Extension clamps whose function is to protect the car from the damaging effect of the chains had become broken off and were not replaced. In short, a considerable amount of damage is continually being done to cars, and this damage can be greatly lessened by proper care on the part of the operators, proper maintenance on the part of the owners and by a few minor changes in the design of the machines.

It is only fair to say that, since the committee's report has been made public, the various owners and manufacturers have taken the matter up and have taken steps to remedy the causes of damage on their several machines.

There is, however, another side to the question, namely, that of car construction. As a general rule the cars of the roads known as coal and ore carriers, are of a construction that is less liable to damage than that of many foreign roads, owing to the absence of projecting parts on the side of the car, such as hand holes, grab irons, ladder rungs, stake pockets, roping staples, drop door rigging, tee iron, angle iron and channel iron braces, etc., but on the cars of many foreign roads one or more of these projecting parts are so placed on the side of the car as to make it impossible for them to escape being damaged when the car passes through a car dumper.

It is highly important that these facts should be considered by all car companies, as well as by all people designing cars for railroads, particularly for railroads that are ore and coal carriers, to the end that wherever possible and practicable cars shall be so rebuilt that these projecting parts can be placed on the car in such a place that the clamping

apparatus will not interfere therewith. For instance, a roping staple, where on the side of the car, might be placed under or on the end of the car.

A good deal of damage that has occurred to equipment going through car dumpers has been slight—not enough to impair the effectiveness of the car—but, nevertheless, in some instances, the car has been made a defective car, because the defects come within the scope of the safety appliance law, and it is temporarily out of business. Thus the question is a broad one, involving the fullest co-operation and interchange of views between car building companies, builders of car dumpers and railroad companies generally, and what is here said as regards railroad equipment applies with equal force to owners of individual equipment. Their designing should be in harmony with the improved railroad designs, and if car building companies are offered designs on which to bid, either for private owners or railroad companies, and such designs call for parts to be placed on the car where it is known they would be subject to mutilation if the car passed through a car dumper, the car constructors could call the attention of the intending purchaser to this.

In one case where a single company operated seven car dumpers, alterations in the original design have been made as a result of the report of the investigating committee of the Pennsylvania Railroad. Again, in some recently designed cars special provision has been made in the sides to sustain the stresses imposed by the clamps of the dumping machines as well as those set up by the tension of the compressed bolster springs after the load has been emptied. These cars are also so designed that all grab irons and handholds are entirely within the line of the stakes and those other parts that are intended to come to a bearing in the machine.

Consequently, while a good deal has been accomplished, there is much more to be done through the co-operation of the interested parties. These steps, however, indicate what should be done. The machines should be so modified as to strain the cars as little as possible, and cars should be used of a design made with special reference to the sustaining of the stresses that will be necessarily improved by the dumping machines.

FOREIGN RAILROAD NOTES.

Work on the Upper Congo railroads has made considerable progress. The first of them, beginning at Stanleyville (which must not be confounded with Stanley Pool, the upper terminus of the old Congo Railroad, which is about a thousand miles further down the river) and extending around rapids 79 miles southward to Ponthierville, is in operation, though chiefly for construction, and nearly all the temporary wooden bridges have been replaced by permanent steel structures. The train makes the trip in five hours. Above Ponthierville four steamers go up (nearly due south) 196 miles further to Kindu, some obstacles to this part of the river having been removed. At Kindu, a second section of railroad 200 miles long begins. Track is laid for 45 miles, and a force of 180 whites and 5,100 negroes are at work. The southern terminus of this section is Kangolo, some 1,800 miles from the mouth of the Congo by the river, but not more than 1,000 in an air line, the river describing a great U.

The work of standardizing the South Manchuria Railway was finished in May, and the new American rolling stock substituted in five days, beginning on May 22. The service is now being regularly maintained on a slightly altered schedule with the new material. The old rolling stock will gradually be returned to the Japanese Railway, from which it was taken during the war. The new equipment set up, tested and ready for service at the time of the change was as follows: Locomotives, 121; combination first and second class passenger cars, 10; second class passenger cars, 44; third class

passenger cars (temporary), 10; mail and baggage cars, 15; box cars, 453; gondola cars, 650; flat cars, 197; cabooses, 100; water-tank cars, 3. There will be no regular first class passenger cars until the end of the summer and possibly no sleeping cars until the fall. Temporary first class cars have been arranged with chairs, and attached to one through train now running daily, leaving Dalney at 7 p.m. and Kwanchengtzu at 7.55 a.m. The passenger mileage rates are as follows: First class, 6.075 sen (3.025 cents); second class, 2.7 sen (1.345 cents); third class, 1.8 sen (0.896 cents).

In Germany complaints were made that the plush covering of car cushions was apt to get dirty, and perhaps harbor disease germs. Investigations were made which showed that woolen and mohair plushes were better than any other materials hitherto used, that linen housing were objectionable, and leather more so, not being able to endure the high temperature required for disinfection. Certain woolen goods lately used for upholstering automobiles, having a smooth surface, promise to be superior to plush, and trials of them have been ordered.

DREDGING EQUIPMENT ON THE PANAMA CANAL.*

The writer during a connection of about two and a half years with the Isthmian Canal Commission, most of which time was spent on the Isthmus, had charge of the design, construction, maintenance, and operation of the dredge plant employed, and intends to give a brief description of this machinery.

There are in use, or being built, four distinct types of dredges of entirely different characteristics: First, the old French ladder dredges; second, American dipper dredges; third, sea-going suction dredges; fourth, pipe-line suction dredges.

The so-called old French ladder dredges are those which the Americans fell heir to when the canal property was purchased from the French canal company. There were some 16 or 17 of these dredges, of the endless bucket type. They vary somewhat in detail, but are all of the same general construction. The digging apparatus consists of an endless chain of buckets holding about 14½ cubic feet each. This chain of buckets is carried by a box girder hinged at the top and of sufficient length to enable the dredge to work to a depth of about 30 ft. The buckets discharge into chutes leading over the side of the dredge and into barges alongside.

The chain of buckets is driven with a pair of steeple compound condensing engines, which are connected with the top tumbler wheel either through gearing or by friction wheels and large sprocket chains. Steam is supplied by Scotch marine boilers working under a pressure of 70 to 80 lbs. The hulls are of genuine wrought-iron, not steel, and some of them were supplied originally with propelling machinery, but this has been taken off. The hauling and hoisting winches are simple but cumbersome and 1¼-in. chain is used for hoisting the ladder as well as for moving and maneuvering the dredge. No quarters were provided for the crews. These dredges were built either in Belgium or in Scotland. Some of them had been pretty well worn out and were of little value. Most of them were in a remarkably good state of preservation, although most of them had not been in use for at least 18 years. The woodwork was entirely rotted away and required renewing throughout. The machinery had been carefully laid up and painted and had been well cared for. It required only cleaning up, packing of joints, and occasionally a rod needed truing up. The hulls, on account of being wrought-iron, had corroded very little and were practically as good as new.

One of these old dredges was rebuilt at Cristobal and put into operation in May, 1905, and a second one was afterward

*From a paper read before the Engineers' Club of Philadelphia, by F. P. Maltby.

rebuilt and repaired. The Panama Railroad Co. was operating one at the Pacific terminus and it was turned over to the Canal Commission in June, 1905, and a second and a third one have been rebuilt at that end.

These dredges of the non-propelling type have hulls of rectangular shape, about 114 ft. long, 32 ft. wide, and 12 ft. deep. The engines operating the chain of buckets are of about 180 h.-p. and are operated condensing. These dredges have no means for breaking up the material to be excavated other than the buckets themselves, and consequently their digging capacity or the ability to force the buckets into hard or compact material is not very great. For these reasons their capacity per day varies with the material to be excavated.

At La Boca, the Pacific terminus, there are two of these dredges in operation, working 24 hours per day and six days in the week. During the month of October, 1907, one of them removed 143,222 and the other one 143,885 cu. yds., an average of about 5,300 cu. yds. per day. The maximum daily output in November was 6,907 yds. and 7,556 yds. respectively. The material handled is mud with a very considerable portion of sand, very easily excavated and handled with this type of dredge. During October, 1907, one of this same type of dredges removed 133,064 yds. from the new channel in Limon bay, or the Atlantic terminus. The reduced output below that of the dredges on the Pacific side is due to a greater seaway on the Atlantic side and also to the fact that the mud encountered is softer, and while it is easier to excavate, it is so soft that it will not pile up in the buckets and more or less is lost during the passage of the buckets through the water. The capacity of these dredges excavating in coral rock is reduced by about one-half. The material excavated is taken out to sea and dumped into deep water, the length of haul varying from two to four miles.

The dredges are served by self-propelling hopper bottom dump barges, which are also a part of the old French equipment that has been rebuilt. These barges have a hopper capacity of about 225 cu. yds. of mud, measured in place. They have steel hulls about 145 ft. long and are driven by twin screws and compound condensing engines. The hopper doors are operated by hand winches.

The operation of these old dredges has been rather surprising and very satisfactory. Their machinery, though cumbersome, is very simple, and very little trouble has been experienced through break-downs. The buckets have cast-steel backs with $\frac{3}{4}$ or $\frac{7}{8}$ steel fronts and bottoms riveted to them. They have an extra cutting tip or edge of 1-in. steel. The eyes in the links and bucket backs forming the chain are bushed with steel and have steel pins. These bushings and pins wear very rapidly, but their renewal is a very simple and inexpensive matter.

The bearings for the lower tumbler wheel, which are constantly working in sand and grit, also wear very rapidly; the journal boxes are of cast-steel and made solid and without any provision for taking up wear. They are usually allowed to run till the boxes are nearly or quite worn through on the bottom.

The cost of handling material with these dredges, including the cost of operation, superintendence, all running repairs, and the cost of operating the barges, is between nine and 10 cents per yard, though monthly costs have gone as low as five cents per yard. This cost does not include any proportion of first cost or depreciation or the first cost of extensive rebuilding.

It is evident that for excavating soft material to a moderate depth this type of dredge has certain advantages that are not appreciated in this country. They are very similar to the gold dredges that have been so extensively and successfully used throughout the West.

The second type of dredge in use is the dipper dredge. This is strictly an American type of dredge and was originated and has been used in this country to a greater extent than any

other type in use. They can be briefly described as a steam shovel gone to sea, as they have all the characteristics of a steam shovel with the parts made usually much heavier and with a radius of action greater than a steam shovel. Three of this type of dredge have been built and are in operation on the canal, one on the Pacific side and two on the Atlantic side. Two of them were built by the Atlantic Gulf & Pacific Dredge Co., after designs made by A. S. Robinson, and the other one by the Featherstone Foundry and Machine Co. All three are of the same size and general construction. Steel has been used throughout, except in the spuds and dipper handle, which are of wood, the latter lined with steel angles and plates.

They have steel hulls 110 ft. long, 37 ft. wide, and $9\frac{1}{2}$ ft. deep, and are proportioned to excavate to a depth of 40 ft. of water. They have dippers with a capacity of 5 cu. yds. for excavating in sand or mud and have extra dippers of 3 cu. yds. capacity and fitted with very heavy manganese steel teeth, to be used for continuous operation in rock.

The main engines operate the hoisting and backing drums and also the drums for handling the spuds, while the swinging is done with an independent engine. They are equipped with independent capstan engines and electric light plants. Steam is supplied by Scotch marine boilers at a working pressure of 150 lbs. The booms are of very heavy construction and about 52 ft. long and are carried directly on the turntable without any overhead galleys frames. The spuds are of Oregon fir, 60 ft. long. On two of the dredges these are single sticks 36 in. square, while on one of them the spuds are built up and are 42 in. square. The main hoisting lines are crucible steel cables leading direct to the dipper without the intervention of any purchase blocks, and all sheaves over which the line passes are 6 ft. diam. On two dredges two cables, each $1\frac{1}{2}$ in. and laid side by side, are used, while on the other one a single cable $2\frac{1}{4}$ in. diam. is used.

The engines, gearing, and drums are proportioned to give a pull on the hoisting line of about 90,000 lbs. These dredges were built under general plans and specifications prepared by the writer, the details being left to the builders.

The principal advantage of this type of dredge lies in its ability to dig in hard material. It has been found quite possible to excavate coral rock without blasting, though the progress of the work is expedited by a small amount of shooting to loosen up the ledges and to permit the dipper to get a better hold on the rock. A somewhat smaller crew is required than on a ladder dredge, though the operator must be a much higher paid man, as the capacity of the machine in any given material depends almost entirely on the ability of the operator to keep it in constant and rapid operation.

Owing to some mechanical defects the operation of these dredges has not been as entirely satisfactory as was hoped, though I understand that these have been remedied to a very large extent. They cost about \$102,000 apiece delivered on the Isthmus. During 20 days in the month of October, 1907, one of these dredges removed 70,000 cu. yds. from the channel at the Pacific terminus, while the maximum daily output in November was 4,456 cu. yds.

The third type of dredge, and possibly the most important, owing to their size and cost, in use on the canal is the sea-going suction dredge. Two of this type have been built, one for each terminus, and one of them has been in operation at Colon since September, 1907. The second one, the "Culebra," reached La Boca under her own steam December 28, 1907, after a voyage of about 12,000 miles, much of it through heavy weather.

These dredges are designed to operate in the harbor entrances to the canal and are therefore built self-contained and are able to work in a considerable seaway. In general design they are very similar to the dredges "Manhattan" and "Atlantic," used in excavating the new Ambrose channel to New York harbor, and to the dredge "Delaware," in use in the Delaware river. They differ from these dredges in the detail

of their dredging machinery and also in their equipment and arrangement of quarters.

Their hulls are of steel, 274 ft. long between perpendiculars and 288 ft. long over all, with molded beam of 47½ ft. and depth of 25 ft. The hull framing is made in accordance with the rules of the American Bureau of Shipping for vessels of class A. 1. They have twin screws and are propelled by compound condensing engines 22x44x30 in. stroke.

The dredging machinery consists of two 20-in. single suction centrifugal pumps direct connected to compound condensing engines running at from 160 to 170 revolutions per minute, and at these speeds developing from 440 to 460 i.h.p.

The centrifugal pumps are located on each side of the ship a little aft of amidships. They have inclosed cast-steel runners about 72 in. diam. with six blades about 19 in. wide. The suction from each pump passes through the side of the ship a little below the loaded water-line and is joined to the suction pipe through a swivel elbow. The suction pipe is 20¼ in. inside diam., ¾ in. thick, and the sections are joined together by forged steel flanges welded onto the pipe. These flanges and the welded point have a greater strength than the pipe itself. The suction pipe is about 63 ft. long over the suction shoe and the dredge can excavate to a depth of 40 ft. of water. The pumps discharge into sand bins having a nominal capacity of about 2,000 yds. Steam is supplied by four Scotch marine boilers 14 ft. diam., 12 ft. long, under a working pressure of 150 lbs.

The dredges are equipped with the usual condensers, pumps, and auxiliary machinery, and in addition have electric lights, evaporators, and a complete ice-making and refrigerating plant.

The dredges are entirely self-contained and are able to operate for a week or more with the coal and stores which they will carry.

Quarters are provided for a crew of about 57 men. The details of the dredging machinery, sand-bins, and arrangement of quarters, etc., were designed by the writer, while the general construction follows that of the dredges previously mentioned. They were built by the Maryland Steel Co., at Sparrows Point, Md., and cost about \$724,000 for the two.

The operation of the one now in commission has been most satisfactory, and there is every reason to believe that the second one will be equally as successful. On their tests they handled from 1,600 to 1,700 yds. of sand and mud per hour.

The centrifugal sand pumps carried a vacuum on their suction side of from 26 to 28 in. Their nominal capacity is about 2,000 yds. per hour in clean sand or sand with only a small portion of mud.

The trip from Sparrows Point to Colon, a distance of 1,906 miles, was made in eight days and nine hours, including about half a day that she was hove to on account of a storm, or an average of 9½ knots per hour.

The dredge is operated for 24 hours per day for five and a half days per week, Saturday afternoon being used for coaling and taking aboard stores.

During the month of September, with a green crew and new machinery, 266,000 yds. measured in place was excavated in the harbor of Colon; in October 273,500 yds. and in November 304,000 yds.

The material is mud and does not readily settle in the bins, though it is readily excavated. By actual measurement it has been found that the pumps have handled as high as 87 per cent. of solid material. The length of haul to the dumping-ground is two to three miles. In commenting on the work of the dredge during September the "Canal Record" estimated that the excavation and disposition of the same amount of material from Culebra cut would have required the work of 14 steam shovels, 30 locomotives and work trains, and about 1,500 men. The crew of the dredge consists of 57 men.

The fourth type of dredge to be used in the canal is the pipe line suction dredge, or a suction dredge which deposits on shore, through a pipe line, the excavated material. The French company had several small dredges of this type, used for re-

handling material, but they were never very successful in operation on account of the design of the pumps.

These pumps had suction and discharge pipes 16 in. diam. The pump runner was about 24 in. diam. and had blades about 4 in. wide. These proportions will perhaps be better appreciated by comparing them with a pump for the same sized discharge pipe which was put on one of these dredges which had a runner 69 in. diam. with blades 11 in. wide inside the shroud.

One of these small dredges was rebuilt and a pump of the size just mentioned put on it. This dredge has been used in filling material into the low ground adjacent to Colon and in opening a channel in the old canal between Cristobal and Gatun, portions of which had filled up. The material from the channel was pumped ashore.

It is proposed to build the great Gatun dam by the hydraulic method or by pumping the material into place. The hydraulic method of dam construction is not new and has been extensively used in the West, but usually in localities where flowing water with a source at sufficient elevation is available for transporting the material. It should, however, make no difference in the success of construction of this nature whether the water is secured from mountains under a sufficient head to give the necessary velocity for transportation or this velocity is given by pumps. For this purpose two dredges are being built, which will first borrow as much material as can be had within reasonable distance of the dam, and will then re-handle and pump into the dam material excavated from the canal and brought to the site in dump barges.

These dredges are of steel, 135 ft. long by 36 ft. wide and 9 ft. deep. They have a single 20-in. pump with double suction, driven by a pair of tandem compound condensing engines developing about 450 i.h.p. The suction pipe is provided with a cutter driven by an independent engine. The cutter and supporting frame are very heavily built and braced and designed for excavating very stiff clay. The discharge pipe is carried on floating pontoons to the shore line and from there to the point of discharge is laid on the ground.

It is not expected that it will be possible or advisable to pump material into the dam and up to the full height with a single pump. It has been found that about 75 ft. head against a sand pump is about the economic limit, as beyond that the necessary peripheral velocity of the pump runner becomes so high that the wear is abnormal. By "head" is meant the total head against which the pump is operating, and will consist of friction in the pipe, velocity head, and the actual lift or static head.

When the head has reached the maximum economic limit it is proposed to use a relay pump. This will be a pump similar to the one on the dredge, but motor driven, and will thus not require any steam plant or foundation, and but little attendance. It will be placed at the end of the discharge pipe, which will lead directly into the suction side of the pump. Its discharge pipe can be extended till the head on the second pump has reached the same limit, when another pump can be added, and this repeated as often as necessary.

It is, however, improbable that more than two pumps on one line will be needed. These dredges have not been completed and are not in operation. Two of them are also being built for the construction of the dams at the Pacific end of the canal, as proposed by the Board of Consulting Engineers. The Canal Commission has just recommended the construction of locks at Miraflores instead of La Boca, which will obviate the necessity of dams near La Boca, but will necessitate the excavation of several miles of sea-level canal, for which work these dredges are admirably suited.

As tending to show the relative capacity of the dredging plant I have described, I will refer to the amount of excavation during the month of November, 1907. During this period the three ladder dredges, three dipper dredges, and one sea-going suction dredge excavated and removed 792,000 yds., while the total amount removed by steam shovels from the Culebra division was 788,000 yds., or the seven dredges removed 4,000

yards more than 42 shovels. Of the total amount dredged, 304,000 yds. was taken out by the dredge "Ancon," which is at the rate of nearly 600 yds. per hour for every working hour she was in commission during the month. The average amount excavated per day of eight hours per shovel is 784 yds., or 98 yds. per hour.

It is realized that it would be impossible for the dredges to do the work performed by the steam shovels, but it is equally true that the steam shovels cannot do dredging work.

There is no desire to detract in any way from the work of the steam shovels, but I wish to emphasize the fact that they constitute only a part of the equipment for excavating the canal.

AUTOMATIC BLOCK SIGNALS ON THE BROOKLYN BRIDGE.

[WITH AN INSET.]

On the Brooklyn bridge, between Manhattan and Brooklyn, New York city, the trains of the Brooklyn Rapid Transit Co.—six-car electric trains, running through to and from the elevated railroads in Brooklyn—are now spaced by an automatic block signal system in which the blocks are only 100 ft. long; the system thus providing for utilizing the capacity of the tracks far more fully than has ever before been attempted anywhere, with absolute block signals; while at the same time overlaps are extended over seven blocks so that, if desired, the speed of the trains need not be limited to a rate slow enough to permit of stopping them in 100 ft. In practice the speed is 15 miles an hour, and trains follow one another in the rush

allowed for comprehending this signal. This puts train 104 in position C, with its front end 1,200 ft. behind the front end of train 102, as provided for in the time table.

A primary reason for adopting this costly arrangement of signals was to insure the minimum distance between trains, 1,000 ft. center to center (positions A and D) for the purpose of safeguarding the bridge trusses which support the tracks. These trusses (not the bridge proper, which consists of cables, suspended) are so balanced on the main piers that a bunching of trains at certain points would throw undue strains on some of the transverse braces. Aside from this consideration, however, a signal system which reduces to 100 ft. the "lost motion" in case of congestion, gives to the operating department the maximum of convenience. In effect there is a "floating" diagram, Fig. 1, the numbers 2, 4, 6, 8, etc., represent home

These signals were made and put up by the Union Switch & Signal Co., of Swissvale, Pa. The locations of the signals are shown in Fig. 2. Fig. 3 is a wiring diagram, showing a section of the line, which is typical of the whole. The arrangement of the control wires for the overlaps may be traced by the numbered wires shown in connection with signals 57 and 59. Those wires which are not numbered are arranged in the same way. It will be observed that on the approaches the block sections are longer. These portions of the bridge are on masonry and the space between trains is not limited by the strength of the structure. To aid in quickly moving trains out of the terminal the overlap arrangement is modified at the starting ends so as not to enforce the 700 ft. absolute space interval any sooner than is necessary. This is accomplished by changing the control wires of the signals so that

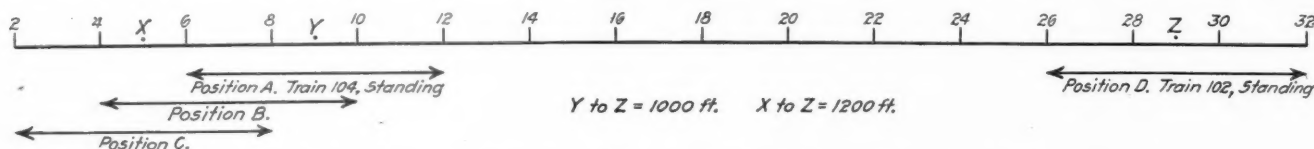


Fig. 1—Spacing of Trains on Brooklyn Bridge, New York City—Train 104 Follows Train 102.

hours with space intervals between them of 900 ft. The regular time table at these hours provides for 64 trains an hour, which allows only about two seconds per train for delays. This time table is calculated on the following basis:

Speed (15 miles an hour)	22 ft. per second.
Time interval between starting of trains	54½ seconds.
64 trains x 54½ seconds	58 minutes.
Two seconds (approximately) per train for errors	2 minutes.
Time interval (54½ seconds)	1,199 ft.
Seven block sections	700 ft.
One block section occupied	100 "
Time (4½ seconds) to allow signal to change position and motorman to observe signal	99 "
Length of train	300 "
	1,199 ft.

The allowance of 100 ft. for "section occupied" provides for the difference in the conditions when trains are moving normally as compared with those when trains are at rest. In the diagram, Fig. 1, the numbers 2, 4, 6, 8, etc., represent home block signals 100 ft. apart. (There are no distant signals except at the ends of the bridge, where the blocks are longer.) Train 102, at rest, holds in the stop position signals 26, 24, 22, 20, 18, 16, 14 and 12, or seven sections besides the last section which its own wheels cover (and also signals 30 and 28). Train 104, also at rest, may therefore stand in the position shown. In these positions the centers of the trains, Y and X, are 1,000 ft. apart. But when train 102 starts, it will have to proceed 100 ft. before it will clear signal No. 12, so that in normal running the trains must have eight sections between them. This would put train 104 in position B. This, however, is not enough, practically, for the motorman must have time to see and comprehend each signal before he reaches it, and in time to obviate unnecessary slackening of speed. It must not be assumed that the signal will change from stop to clear instantaneously or that the motorman can "find" and interpret it the moment it moves (while he is exactly abreast of it). Therefore, another block section (4½ seconds, or 99 ft.) is

when a train clears the eighth signal behind it, it clears the seventh also; and so on, two at a time, until the following train has got in motion at approximately the same speed as itself. This gives clear signals less than 800 ft. apart; but the privilege of running closer to the train ahead which thus is given to a train starting out of the terminal cannot be used by it because, in consequence of the delay which has already been imposed at the terminal, and of the steep rising grade in the track, it is impossible in the ordinary course to run fast enough to get within 700 ft. of the preceding train.

A train approaching the terminus passes the last of the closely spaced signals at a point 800 ft. before it reaches the end of the suspension span; but the 100-ft. track circuit sections continue to the end of the span and the beginning of the masonry "approach."

The feed wires carry a 500-volt alternating current, 25 cycle. At each signal it is transformed to 50-volt for the signals and to 10-volt for the track circuit. The track relays, alternating current, are like those used in the New York subway.

The signals, which are shown in Figs. 4 and 5, have no moving parts. Like those used in the Hudson & Manhattan tunnel and those to be used in the Park avenue tunnel of the New York Central, in New York city, they are lights—a separate light for each indication. Each light consists of two 16 c.p. lamps, and the lenses are 5 in. in diameter. The function of the track relays is simply to close the circuit of one or other of the lights, according as the indication is to be "proceed" or "stop." The change from red to green or green to red occupies less than two seconds. The tracks on the Brooklyn bridge have no cover to exclude sunlight, but the lights, hooded as shown in the illustrations, are said to give satisfactory and easily discernible indications in the brightest day. The upper light

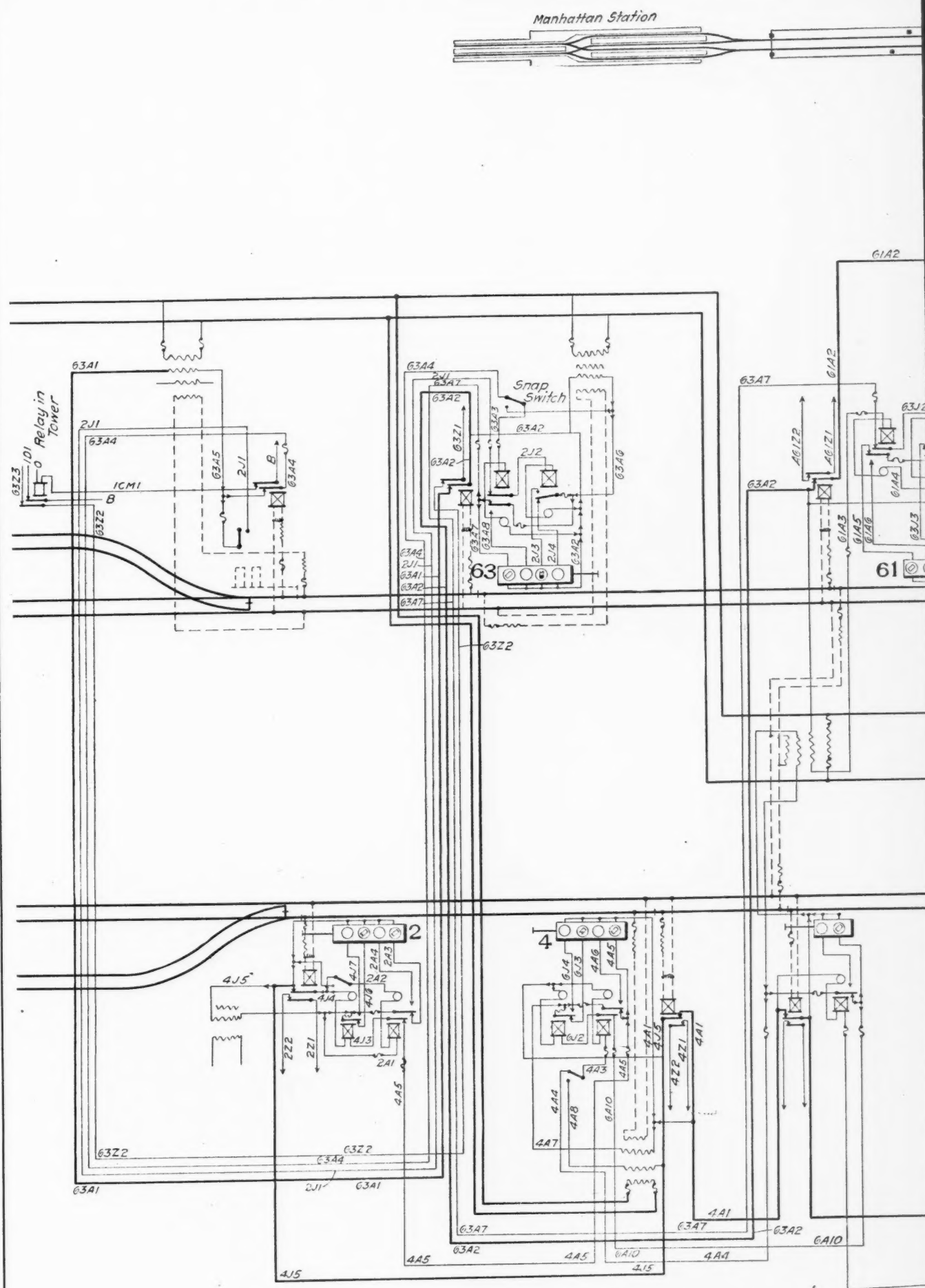


Fig. 3—Ty

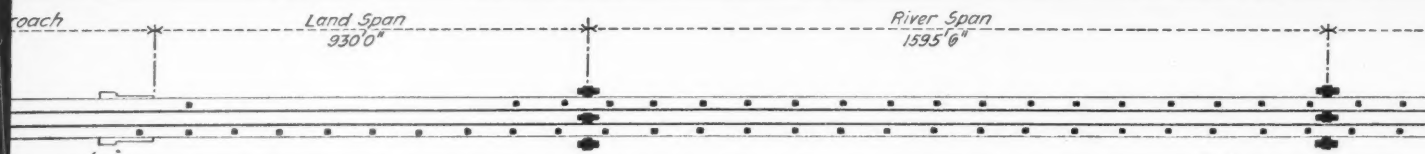
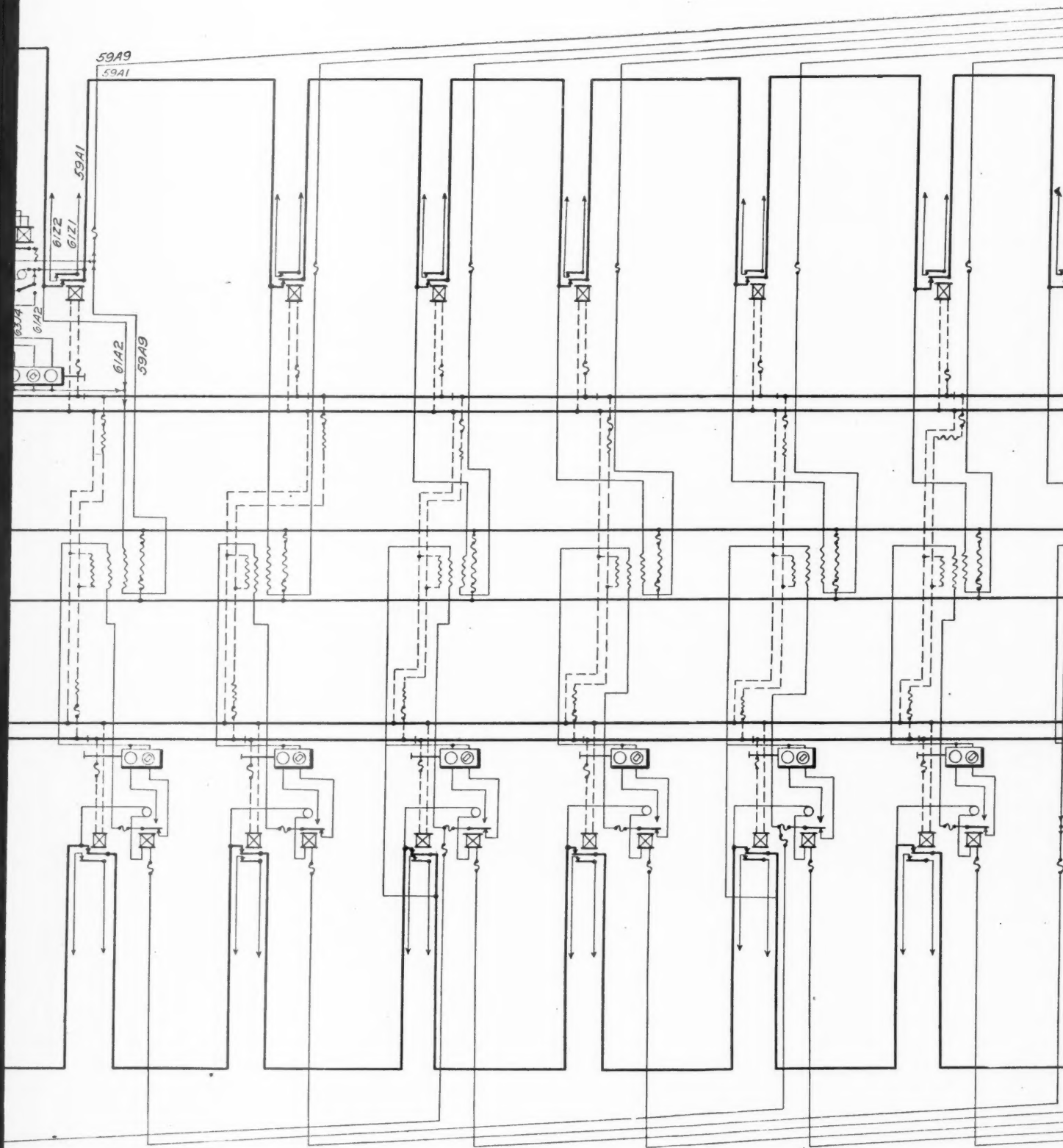
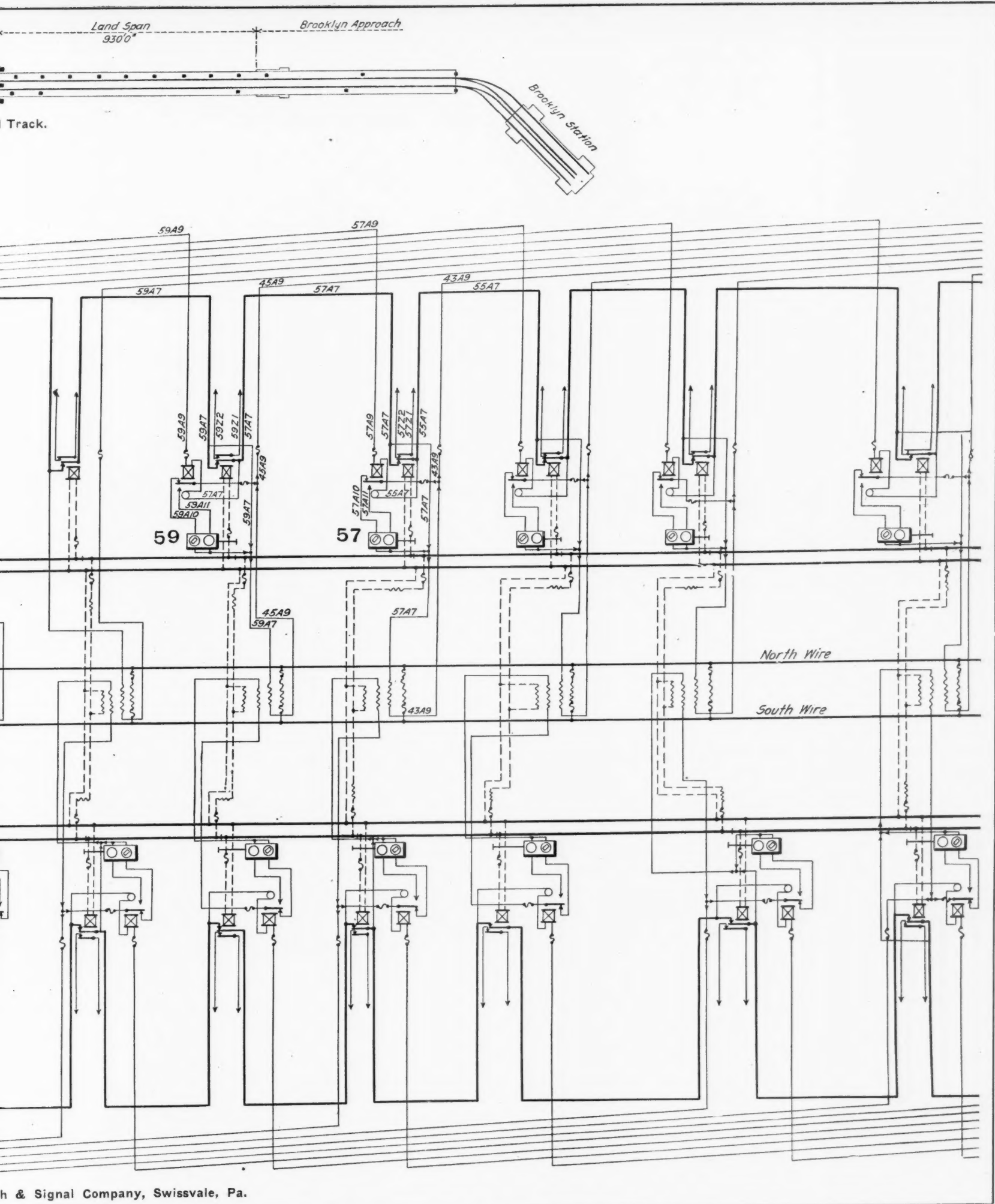


Fig. 2—Locations of Block Signals on Brooklyn Bridge, New York City. Trains Run on Right Hand Track.



Typical Arrangements of Wiring for Automatic Block Signals on Brooklyn Bridge, New York City. By the Union Switch & Signal Co.



is the green and the lower the red. In the distant signal's yellow is the caution indication. Not only the signal, but some of the other apparatus was specially designed to meet the requirements of clearance and other peculiar conditions on the bridge.

The automatic signals have been installed, for the city of New York, which owns the bridge, in conjunction with two electro-pneumatic interlocking plants, one at each end of

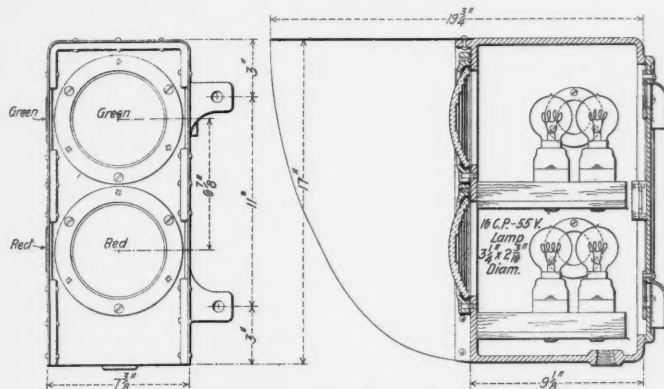


Fig. 4—Block Signal Used on Brooklyn Bridge, New York.

the bridge; but the interlocking is provided by the Brooklyn Rapid Transit Co., which operates the trains, though the work was all done by the Union Switch & Signal Co. These interlocking plants are equipped with electric "detector" locking, no detector bars being used; and all of the signals are dwarf semaphores, some of them being mounted on pedestals

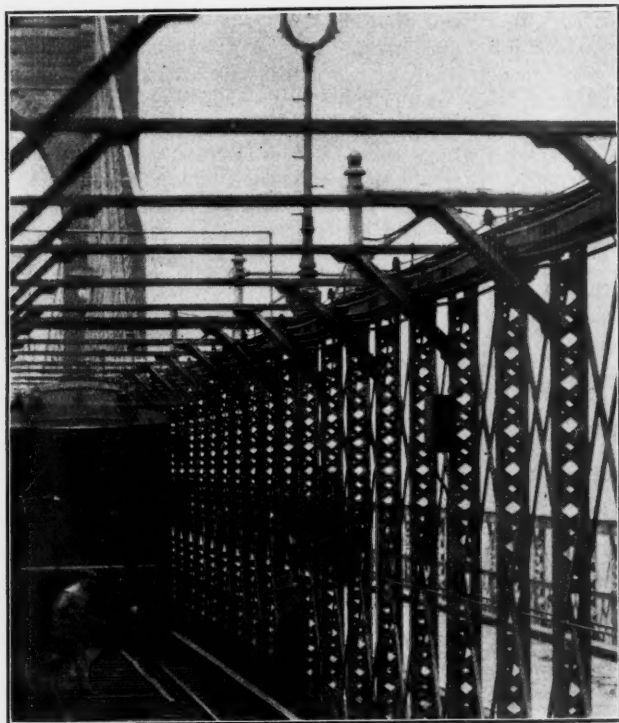


Fig. 5—"Sight" Signals of Brooklyn Bridge Block System.
Signal 7 at right of cut; signal 9 100 ft. beyond.

about 8 ft. high. The switch movements and machines are the signal company's standard apparatus.

The chief engineer of the New York city bridge department is C. M. Ingersoll, and the engineer in charge of the Brooklyn Bridge is K. L. Martin.

The Italian State Railroads in the year ending with June last earned gross $7\frac{1}{2}$ per cent. more than in the previous year; the earnings per mile were \$10,186 per mile this year, against \$9,535 last year.

STATE CONTROL OF RAILROADS IN ENGLAND.*

BY R. L. WEDGWOOD,

Divisional Goods Manager, North-Eastern Railway.

The most significant feature of the present state of public opinion, in England in regard to government control of railroads, is that there is no longer any demand for competition between railroads; on the contrary, competition of all kinds is now labeled "reckless" and is considered to be itself a cause of unnecessary expense and of high rates. The cry now is for the abolition of competition, and, with it, for increase of state control. If we are thoroughly to understand the present situation we must consider to some extent the past history of the relations between the state and the railroads. Let us then in the first place look at the general situation with regard to state control.

The control of the state begins with the very birth of the railroad—in fact, even before birth, for it is first necessary to get an act passed by Parliament authorizing the railroad to exist. The purposes for which Parliament insists on all railroad proposals passing through this preliminary test are mixed; these acts in the first place give the new corporation the right to compel owners of land to sell their property. This is a serious matter, and a strong case must be made out that the demand is "in the public interest." This is the first purpose of the proceedings before a parliamentary committee, and in a long-settled country like England no one would now deny that some inquiry of the kind must be held. Whether the price ultimately paid for the land is an equitable one is another question, but at least the state is not directly responsible for it.

Secondly, under cover of the question of "public interest" full representation before the parliamentary committee is given to rival railroad companies, and this is where the expense of these proceedings mostly arises. It is not for the railroad companies to complain of this expense, since its purpose is to protect them against one another; and they themselves control the situation. Perhaps if the committees were to take a shorter way with the ingenious arguments of learned counsel the expense of the proceedings might be reduced, but then the railroads in possession would at the same time be less secure in their title.

The third purpose of a Parliamentary inquiry is to obtain some guarantee of the financial genuineness of an undertaking, and this again is at least as much for the protection of other railroads as for the protection of prospective shareholders; the purpose of this section of the parliamentary inquiry is not so much to ascertain whether an undertaking will pay, as to make sure that its promoters are really in earnest. Allied to this has been the parliamentary action on matters of finance, limitation of the issue of debenture stock, and so on. I need not enter into detail, and will only say that such action has been taken in the interests of the investing public and has been sound and well conceived. It has largely saved English railroads from the mill-stone of a top-heavy bond or debenture issue which has been the bane of so many American railroads. Looking at the action of parliamentary committees as a whole, I think one is entitled to say that they do their work with reasonable efficiency; within reasonable limits they protect the public against the speculative railroad; they protect the railroads against unfair encroachments on the part of one another; they even protect an individual railroad against itself so far as certain elementary financial matters are concerned. Committees are not always wise, and not always just—the remarkable thing is that with such mixed materials the results should be so satisfactory.

So much for the control of the state over the creation of the railroad as a legally existing body. Let us now consider the control of the state over the construction of the road, and over its operation. I am compelled to treat these two stages together, owing to the way in which they run into one

*From a paper read before the York Railway Debating Society.

another. The state controls the construction of a railroad in order that the subsequent operation of it may be carried out under the conditions laid down by the state. Before a railroad can be used for the conveyance of passengers it must be passed by the Board of Trade as coming up to a certain standard fixed by themselves. This is a very definite instance of state control; it is one which has grown up by degrees, and to which we are so well accustomed that complaints against it are seldom heard.

The standards at present fixed have been evolved as the experience of many years and of numberless accidents. They are very high standards, and it is expensive to conform to them; but at least they have achieved their result. It is difficult to say whether English railroads are safer than others; accidents go on, and within the past few years we have had rather a bad run of them, but at least this is certain that railroad traveling in England is much safer than it used to be. One has only to compare the English position in this respect with the position in America, where a terrible series of railroad disasters extending over several years has involved enormous expense to the companies themselves, and forms one serious item in the very formidable list of grievances which the American public have drawn up against the railroads.

One hears the necessity of coming up to the Board of Trade standards referred to sometimes as the cause of the excessive capital cost of English railroads per mile of line; it is convenient to throw the responsibility for this unpleasant phenomenon on the shoulders of a public department, but I doubt if 1 per cent. of the cost per mile can with any fairness be attributed to this cause alone, and I believe the general consensus of railroad opinion at the present time would be that the money spent in conforming to Board of Trade standards was on the whole well spent and in the best interests of ultimate economy; in a word—that state control had justified itself in this department.

There are two points worth noticing in regard to the way in which that control has been exercised, which may at first sight seem contradictory. The methods of the Board of Trade are conservative and at the same time they are progressive. They are conservative because it has never been the custom of the Board of Trade to force the application of any remedy which has not been tried, and possibly adopted in the best practice; they have all along endeavored to leave the initiative in reform to the railroads themselves—merely coming in after the event to secure the uniform adoption of appliances or regulations which have justified their existence in this way. There is no apparent tendency to alter this principle, which is characteristic of English practice in matters of this kind. In the second place, the Board of Trade supervision is progressive; they do not stand still at any moment and say, "perfect safety has now been obtained—we ask no more"—for one need hardly say that perfect safety has not yet been obtained and, even if at any time this had been the case, the circumstances as to speed and density of travel alter so rapidly that perfect safety to-day would cease to deserve its title next year. The standard of the Board of Trade, therefore, must rise and ought to rise; the block system may satisfy our needs at the present time, but the next generation of railroad men may live to see it develop into lock and block; we leave the engineer the full responsibility for obeying his signals to-day, but in a few years some system for the automatic application of the brake may be accepted as a matter of ordinary precaution. The objects of the policy of state control in this department may be summed up in the word safety—safety, first of all for the traveling public, secondly, for the railroad employee.

Where the state goes beyond this initial control into a more detailed control of the working, it is worth noticing that the form of control undergoes a considerable alteration. From being an absolute control, backed by the power of refusing to a railroad the permission to carry passengers, it becomes per-

missive, a control resting on recommendations, on pressure of a more or less indefinite character, in the last resort on mere publicity. The Board of Trade is authorized to make an inquiry into any railroad accident of a serious character, and a long series of most valuable reports have been made; these reports have been accompanied by recommendations and suggestions of a useful kind, and the Board of Trade inspectors have now come to be recognized as the most competent and impartial critics of railroad operation on the side of safety. Any recommendation coming from the Board of Trade has behind it the prestige of 40 years of sane and helpful criticism; it may have no compelling force in law, but the force of that long record of approved publicity carries a more overwhelming weight than any law. It would not be an easy matter to stand out against the express recommendations of the Board of Trade on the subject of safety; indeed, there is no general tendency to do so, and railroad operating officers generally accept the recommendations of the Board of Trade on this subject as reasonable and impartial.

It is, perhaps, a doubt on this last head which has militated against an equally willing acceptance of the Board of Trade supervision in another field—the hours of railroad employees, and, generally, the conditions attending their work. On this head the board's controlling powers are more strictly limited than under the foregoing; they may call for returns, they may press for reduction of hours, but beyond pressure they cannot at present go. Their action in regard to the hours of railroad employees has earned by no means the same approval among railroad officials as their action in regard to safety. In part this is due to an unregenerate objection on the part of railroad officials to the interference of third parties, even if the third party be the state; and in part also to the feeling that the state itself was acting at the bidding of a working class electorate and hampering the railroads of the country in order to get credit at the polling-booths. There can be no doubt that some of the interference has been fussy, and has been directed to the reform of what one may call unessentials—reforms which have cost the railroad companies money which neither they nor their employees have got back in really improved conditions of service; and yet here again we must on the whole recognize that the general effect of Board of Trade pressure has been, if not good, at least not out of line with public opinion. In the matter of hours it has been in a measure the function of the Board of Trade to remind the railroads that the social point of view cannot be neglected, and in doing this the board has performed a useful and moderating function.

Some of you will, perhaps, be thinking in this connection of the new Wages Conciliation Boards and of the part played by the Board of Trade in the negotiations which led up to their establishment. On that subject I will only say that the conclusion of such an agreement at the invitation and under the auspices of the Board of Trade is a great tribute to the past impartiality of the Board, and an illustration of the view here put forward that in the merely moral pressure it is able to exercise, the board has in its possession a stronger instrument, and an instrument more universally applicable, than any series of absolutely restrictive laws could ever give. One may also hope that the institution of these boards may to some extent relieve the Board of Trade of the work it has been doing in connection with the supervision of the hours of railroad men; if this should prove to be so, the result will be an excellent one. It is just in connection with this work that the board is most open to the suspicion of playing to the gallery, and our most precious possession in the present condition of railroad matters is the reputation of our state departments for impartiality.

The control of the state over the rates charged by the railroads is the crux of the present situation. The working classes may hope for some more definite intervention in the direction of cutting down the hours worked, but the demand

is not strongly formulated and the Conciliation Boards are to some extent the answer to it. What will be the answer to the demands of the business community? Under the Orders Confirmation act of 1892, a classification of freight is laid down, and certain maximum rates are fixed, arranged so as to cover every class of freight, and every distance. These maximum charges were based approximately on the existing rates in 1892, and were lower than the previously existing maxima under which the construction of the various railroads had been authorized, but the principle of prescribing a maximum has been recognized from the outset as the natural right of the state in view of the special facilities accorded to the railroads in the matter of construction. In thus fixing a maximum, and even in modifying it from time to time to meet materially altered conditions, the state is adopting substantially the same attitude as with the construction of the line—certain main outlines must be conformed to; within those limits the railroads, broadly speaking, may do as they please. But unfortunately in dealing with rates the state has in recent years gone further than this.

Under the Railway and Canal Traffic act, 1894, all increases of rates from December 31, 1892, are placed under special conditions. The shipper is at liberty to complain to the Board of Trade against such increases of rates as being unreasonable, and to take the case before the Railway and Canal Commission. The burden of proof is then laid on the railroad company to show that the increase complained of is reasonable. This places the railroad company in an altogether exceptional position; as a defendant in a legal action it is considered guilty until it is proved to be innocent. So far the act as a specimen of the impartiality of the state is bad enough, but the interpretation which the Commissioners have felt themselves bound to place on the act has made it operate even more prejudicially to the railroads. The Commissioners, when this act first came up for interpretation, were called on to assign a meaning to the phrase—a reasonable increase of rates—and for their guidance it is stated in the act that to prove that the increase is reasonable "it shall not be sufficient to show that the rate is within any limit fixed by an act of Parliament, or by any provisional order confirmed by act of Parliament." That is to say, that although the maximum rates had recently been fixed by Parliament, and were presumably therefore reasonable, an increase of rates within those maxima might not be reasonable.

Starting from this rather inconsistent beginning, the Commissioners have completed the matter by interpreting the law in a way which was probably quite different from the intention of Parliament. Parliament perhaps had some hazy notion of constituting the Railway Commissioners into a kind of arbitration court, which would consider the rate questions brought before it on general commercial grounds. They had no business to contemplate any such thing, and the Commissioners refused to view themselves in this light, or to judge the cases in any other way than by established law and precedent—what was the result? In order to prove that an increase of rate is reasonable, there is, broadly speaking, only one course open to the railroad companies, viz., to show that *the cost of handling* the particular traffic concerned has gone up, and not only so, but to prove that it has gone up to an extent not less than the increase of the rate.

The point on which I wish to lay stress here is that this piece of legislation, as interpreted, is out of keeping with the general spirit of state control as understood in England, and for the following reasons:

(1) The act has been judged not unreasonably to indicate a disposition on the part of the state to prejudge the case and to act unfairly by the railroads. This attitude on the part of the state has left an inheritance of distrust, and whereas in other provinces of state control the railroads look to the state department concerned, as to an impartial critic, almost as to an adviser, in the matter of rate regulation it is too much the habit to look on the state as a secret enemy.

(2) The second reason for stating that in the act of 1894 the state has given up its usual attitude in dealing with the railroads is this. In other acts the state has confined itself to control. The act of 1894 is no longer control but interference. In previous enactments the railroads were free to adjust their rates up and down to suit the changed circumstances of traffic so long as they kept within the bounds of the statutory maxima. The effect of the act of 1894 has been to put an end altogether to this freedom. In that act, as interpreted, the state practically intervenes to fix the actual rates which shall be charged. The railroads are no longer left the fundamental liberty of raising their charges, except under conditions which are almost prohibitive, and not even the state itself can authorize such an increase except by special act. It is true the railroads may lower their rates if they please, but each rate as reduced becomes, automatically, a cast iron maximum.

I need not dwell on the difficulty of proving an increase in the cost of operation. This can be done in a very rough manner in the case of large groups of traffic, mineral traffic for instance taken as a whole, and such increases of rates as have been attempted since 1894 have mostly been of the character of a general percentage increase of rates on a large group of traffics, but the attempt to raise rates even here has met hitherto with only partial success. In one or two cases railroads have got a part of what they have claimed, say 3 per cent. where 5 was wanted; in others, as for instance in the Scotch coal rates cases, they have been held to have failed to justify any advance at all.

It is not an ideal condition of affairs in railroad matters that the advances should be confined to sweeping increases of this sort, and that there should be no liberty to modify individual rates in an upward direction. It is possible to prove an increase in the cost of handling mineral traffic, but who is going to prove that the cost of conveying ships' winches or sheet lead has gone up, and submit figures to substantiate his proof in detail? We do not know the cost, we cannot know it without adopting a whole series of conventions which make the result at the best artificial, and those conventions might be summarily rejected by the Commissioners. Rather than go to the expense of fighting the matter out, it is better to leave the rate as it stands, and recoup one's self in other directions. This is the position which is forced on the railroad companies.

I may further add that the criterion adopted by the Railway Commissioners places a premium on bad management; to economize in operating costs is to rob oneself of the only weapon for securing an increase of rate; spend money lavishly and the way, relatively speaking, is clear.

It will thus be seen that the effect of the act has been, in a measure, to stereotype the rates as they existed on December 31, 1892, with such reductions, to speak correctly, as were necessarily brought in on January 1, 1893, under the revised maxima. It is not, of course, true that the act of 1894 has put a stop to all reductions; far from it; but it has compelled them to take the somewhat questionable form of time rates—rates for a given quantity to pass within a given time—these rates drop out of the rate books when the period for which they were quoted has elapsed or when the traffic has passed, and they are sound in principle; but a regime of special quotations of this kind is open to certain obvious objections.

Meanwhile it is humorous to notice that the question of increased cost of operation, which has been made to assume such a fictitious importance in connection with increases of rates, is in most cases quite an irrelevant consideration. The question of cost of operation only enters where very low special rates are under consideration. The only cost of operation that can be ascertained with any approach to satisfactory accuracy is the bare cost of moving traffic. That cost operates as a minimum below which it is folly to go. Beyond that the allocation of the other more or less general costs

must be arbitrary, and is not the decisive factor in fixing a rate. Increase of costs may set us looking for rates that are unreasonably below what the traffic will bear, but the justification for the increase of rate is not the increase of costs but the fact that the rates are below what the traffic will legitimately bear. Those rates may have been quoted under special circumstances now forgotten, they may have failed to create an anticipated traffic, or they may be simply out of keeping with the general run of rates on similar traffic for similar distances. Those are the sort of considerations which would and should actuate a traffic manager in deciding on an increase of rates, and it must be borne in mind that, with all the notices which have to be given, an increase of rates, apart from the act of 1894, is at no time a thing to be lightly undertaken.

In dealing with the act of 1894, one ought, however, to recognize the difficulties of the case. It may well be that some legislation was needed. The railroads were advancing rates all round, and it was not unreasonable to call on them to give their justification for these increases and to create machinery for dealing with such cases in the future—perhaps to call into existence some arbitration proceedings for dealing with such matters providing that a perfectly impartial court of arbitration could be assured; but Parliament went the wrong way about it, for their action was in the first place quite obviously *not* impartial, and secondly, the Railway Commissioners whom they hoped to constitute arbitrators quite naturally could not act in that capacity. Such a body should be able to take into account all the circumstances which would affect a reasonable traffic manager in deciding to raise a rate, and should be at liberty to demand from the railroad company proof that the increase was fairly governed by one or other of these considerations, and this the Railway Commissioners as a court of law found they could not do.

The act of 1894 has been so unsatisfactory to the railroads that one might expect to find the business public extremely well satisfied with it. It is remarkable, however, that this has not been the case. Naturally the business community does not thank the state for having compelled the railroads to stereotype their rates, and this appears to have been the principal result of the act. We have not heard the last of the business man's views of the railroad situation—in fact, as competition with foreign countries becomes more severe, and it must undoubtedly do so, we shall certainly hear more of it. It is this dissatisfaction of the business community which is the most serious feature of the situation, and is beginning to find its expression in the demand for railroad nationalization. Now, whether nationalization is to take place or not, it is at least a possibility, and we must recognize that, if ever it comes to pass, a good deal will turn on the spirit in which the railroads are taken over by the state.

We may meet the present situation in one of two ways: On the one hand we may stand up for what we consider our vested rights; we may refuse to offer any concessions; we may leave the shippers to fight their own battles. On the other hand, we may take the public into our confidence, we may explain to them frankly the difficulties of our position, and we may in many ways show our desire to meet the wishes of the trading public so far as we can do so without danger to our financial interests.

What will be the respective results of these two attitudes in the not impossible event of railroad nationalization? In the first case we should be taken over as a monopoly that has failed to move with the times, and become a public obstruction, if not a public enemy; in the latter case we should be taken over as an institution which with the best intentions is no longer suited to the circumstances of the nation; it would be felt that the increasing national need of low rates, if there be such a need, was not a matter for which the railroads could be held responsible, and that faced as they were with the steady growth in expenses—in coal, in wages, in rates and taxes, they could not be expected to satisfy that

need under the ordinary conditions of commercial management. The difference might have an important bearing financially on the terms of the final settlement.

The business man's indictment of the railroads may be put under three heads—that the rates are too high; that the rates are unequal, and that the railroad policy as a whole is too secret.

The business man considers German rates to be much lower than English rates, and he attributes the difference first to bad management on English railroads, and secondly to their heavy competitive expenditure.

Secondly, in accusing the English railroads of inequality of rates, it should not be thought that what the business public wants is equal rates in the sense of rates based on an equal mileage principle; it is rather a demand that rates should be equitable, based if possible on a scale of some kind, and rising according to distance on some intelligible and consistent principle; and that, apart from special circumstances, the same commodity conveyed the same distance shall always be charged at the same figure. This condition it is alleged is not fulfilled by the English railroads. The grievance under this head is perhaps even more acute than that under the first head. Apart from questions of foreign competition, the trading public as a whole are more concerned in having equitable rates than in having low rates. Inequality favors certain traders and certain localities at the expense of other traders and other localities, and this is certain to be keenly resented. English railroads have grown up from combinations of smaller lines, each of which perhaps had separate scales of charges; these scales have persisted after the amalgamation. In other places temporary competition of some sort has forced down the rates in certain directions—the competition has terminated but the rates have remained. This is the historical explanation of the matter, but it should not be forgotten that it is not a justification.

Under this head again the shipper is able to point to the German railroads, where we are told the great bulk of rates are quoted on definite scales well known to the public. I do not think those scales are perfect, but at least every member of the public knows exactly where he is and feels sure that his competitor in the next county or the next town is not getting the better of him.

The third head in the business man's indictment is that railroad policy is unduly secret. Perhaps what has contributed more than anything else to the persistency with which the policy of reserve has been followed by the railroads has been a certain fear of the state, as a malignant spirit waiting to take any advantage of the railroads which circumstances may offer. According to this view the railroads are like the tortoise, which is safe so long as it sulks under its shell, but let it once put its head outside its shell, even with the laudable purpose of explaining its position, and mischief will follow; just so the railroads will find the government standing by like a nigger with a big stick, and will be left with no head at all to put out a second time.

If the view I have put forward of the relations between the state and the railroads is a fair one, then the tortoise and the nigger theory cannot be sustained. State control has gone on increasing from decade to decade, but viewed as a whole the control has not been without its advantages to the railroads, and has not gone in advance of reasonable public opinion.

There is one exception to this, and that is the act of 1894. It was decided in 1888 that the maximum powers of the railroads should be revised in the direction of making them more uniform, and bringing them more nearly down to the actual rates which were being charged. As a matter of fact, when the Board of Trade issued its schedules it was found that the maxima were, in many cases, below existing rates; the railroads refused to accept them, but they were ultimately passed into law, with slight modifications. The railroads had a legitimate grievance in the haste with which the new sched-

ules were forced on them. The new maxima were passed in the middle of 1892; they had to come into force on January 1, 1893; the time was too short to effect a complete revision, and until a complete revision could be made the railroads considered that they had no alternative but to raise temporarily a number of exceptional rates up to the scale figures. But the decision of the railroads, substantially justifiable in itself, was carried out in a way which exasperated shippers, and suggested to them that the motive was not reasonable business prudence, but temper. The public was thoroughly alarmed, and the act of 1894 was the result. It was a piece of panic legislation, and one can see that the circumstances which led to it were altogether exceptional. Those circumstances have unfortunately left the business public with a suspicion that the railroads are hostile to the business of the country, and in their policy at once secret and autocratic.

Now with the public feeling at this pitch, I wish to urge that some departure from the policy of reserve is very desirable. The public have a right to criticise, and to look for an answer—a right founded on the exceptional position of the railroad companies as rate-makers. If a man wants to buy any ordinary commodity there are a dozen people he can go to, or, in many cases, as a last resort, he can do without the thing altogether. But transportation is in a different category for it is an absolute necessity, and it is becoming an absolute monopoly. It is for this reason that the exercise of the right of rate-making is such a delicate matter; and if the railroads are to retain it, the right must be exercised with the utmost openness and moderation. We must recognize that in the rate problem the prosperity of the whole country is intimately involved, and that the influence of rates on the position of this country as a producing and distributing center is almost incalculable.

We must admit that the present system has its faults, and that it has not secured equality of rates, even within the limits of the principle of charging what the traffic will bear; on the other hand we can make good our case that the present system is more elastic than any system of state-fixed rates, and that if it were not for the rigid application of the act of 1894 the system could be made more elastic still; nor would it be denied that elasticity is one of the cardinal virtues in a system of rates. We can bring good evidence to show that having regard to costs of all kinds, our rates, as a whole, are not unduly high, and that any policy of wholesale reduction would be the wildest speculation for companies which have their shareholders' interests to consider.

Our attitude towards the state would then be this: "If you want rates lowered wholesale, if you consider that such a step is necessary to maintain our national position in trade, we are not in a position to object, but you should take us over on fair terms. If you do not want such a sweeping change we think a continuance along present lines can be made to give you satisfaction; we can give you an elastic, adjustable system of rates, and we are prepared, if you wish, to deal with the question of inequality on reasonable lines, if you give us the liberty of leveling up in some cases we will level down in others. We claim that such an arrangement will give you the best rate system which is compatible with private management."

Might we not take a leaf from the German book and adopt something on the lines of the Prussian Advisory Councils? These are local bodies covering wide areas; they consist of representatives from local chambers of commerce, local industrial associations and agricultural societies, and from other similar bodies of a semi-public character; their duty is to consult with the local railroad management on all important matters concerning rate schedules and other questions of the kind. The idea is more English than German and might very easily be developed into some system of district railroad conferences of a purely English character. This is an age of Conciliation Boards—could we not apply conciliation to rate matters? Let the conference be selected over a wide area

from all branches of business—shipping, manufacture, distribution, mining, agriculture—and it seems fair to suppose that the power of an unreasonable section to force its views on the whole council would diminish, while the matters which the council was unable to settle satisfactorily would be few, and would be matters of real principle, such as the Board of Trade might ultimately deal with more or less on present lines. The main value of the suggested railroad conferences is that they would serve as a safety valve for the future, and provide the possibility of further developments along relatively familiar lines of state control as opposed to state ownership.

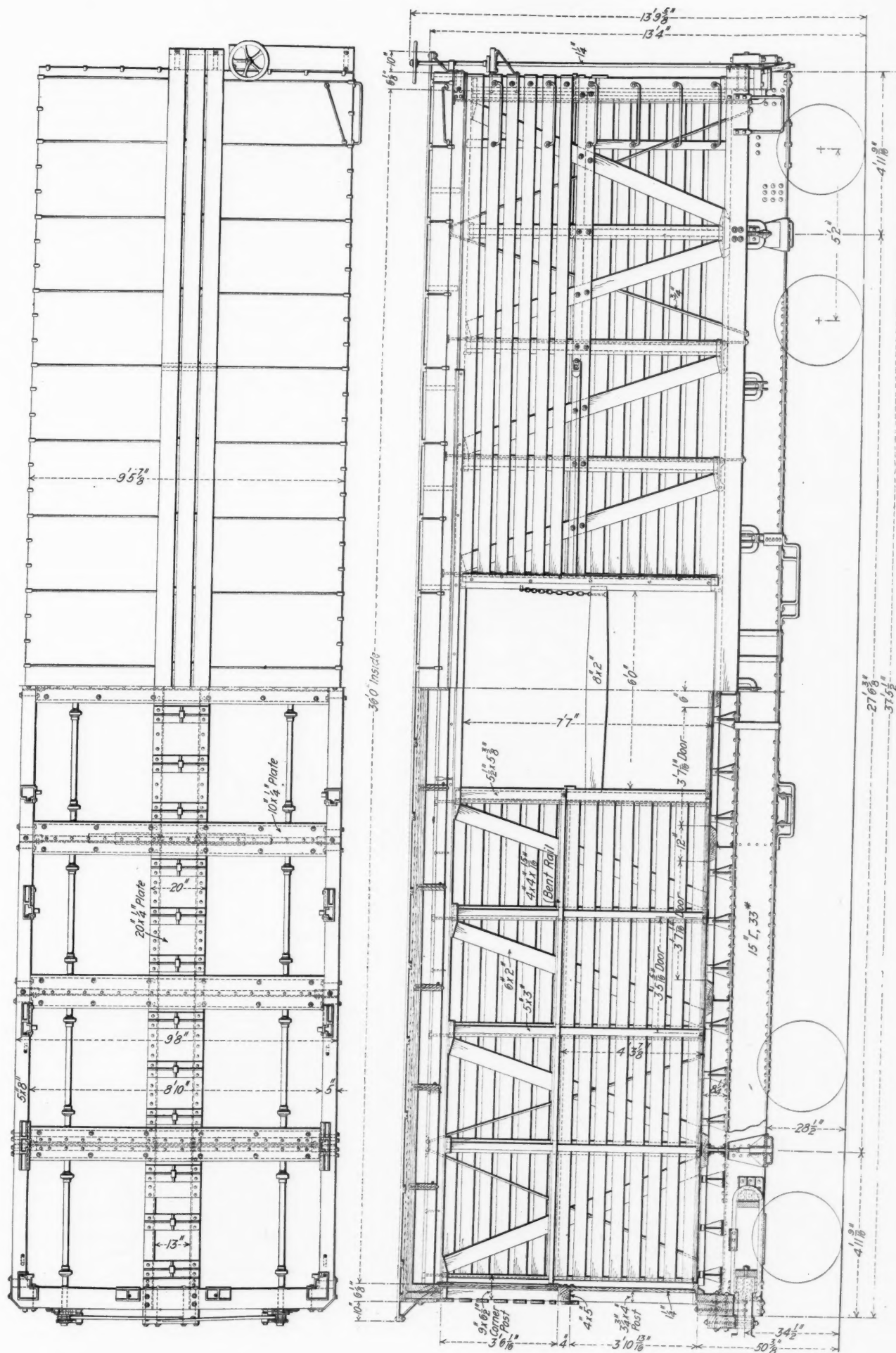
The policy of the state in Great Britain has been, broadly speaking, *control not interference*. The state has not said to the railroads, "This particular thing you shall do, and do as I tell you to do it," but it has said, "Here are your limits—thus far you shall come—within these limits do as you think best for your shareholders." That is a sensible, thoroughly English policy, and I think we have reason to be proud of the results. No one party in the state has been responsible for the steady increase of state control; Liberal and Tory alike have passed their railroad regulation acts; each party in turn has acted as the interpreter of public sentiment; we are controlled not at the dictates of a section but by the wishes of the majority of our fellow-countrymen. We do not justify ourselves by the policy of reserve, we can only justify ourselves by coming out into the open and arguing our case. Public sentiment moves in waves, and we are near the crest of one such wave now. On the one hand the public sees (or fears more than it sees) the inroads of German or American trade backed by lower rates than anything the English railroads can offer—on the other hand they see English railroads embarking at last with energy on a policy of combination; and they regard this policy as the definitive abandonment of the competitive era among English railroads. But the effectiveness of competition has been our great argument for independence hitherto, and we can hardly look therefore to pass through the next few years without having the question of increased state control brought unmistakably before us. As to the manner in which the question is brought before us, much will no doubt depend on the policy adopted by the railroad companies themselves; the settlement of the labor question has led to a noticeable reaction in favor of the railroads, and if the same conciliatory spirit is maintained one may perhaps anticipate that the railroads will not find the final settlement altogether unsatisfactory.

THE RALSTON GENERAL SERVICE CAR.

Among the rolling stock exhibited at the June conventions in Atlantic City, there was a car known as a general service car, shown by the Ralston Steel Car Co., of Columbus, Ohio, of which a cursory description was published in the daily edition of the *Railroad Age Gazette* on June 23. This description is now supplemented by one that is more complete with engravings showing the construction in detail.

As its name implies it is intended for use in all branches of freight transportation. It is built with a steel underframe and wooden superstructure which is so designed that it may be used as a box or a stock car, or as a car for coal, coke and similar lading, with the advantage of having a floor which, by a slight pull on the levers located at the end sill, drops at an acute angle, cleaning the car of its lading in a very short period of time. Added to these advantages is the construction of the car throughout, which makes it able to withstand severe usage in all forms of service.

The center sills of the steel underframe are two 15-in. 33-lb. channels set 13 in. apart and notched at either end, and the web of the channel bent down, forming a shelf to receive the wooden end sills of the car. This method is one of the well known features of the Ralston underframe construction. These channels were reinforced on the top by a cover plate

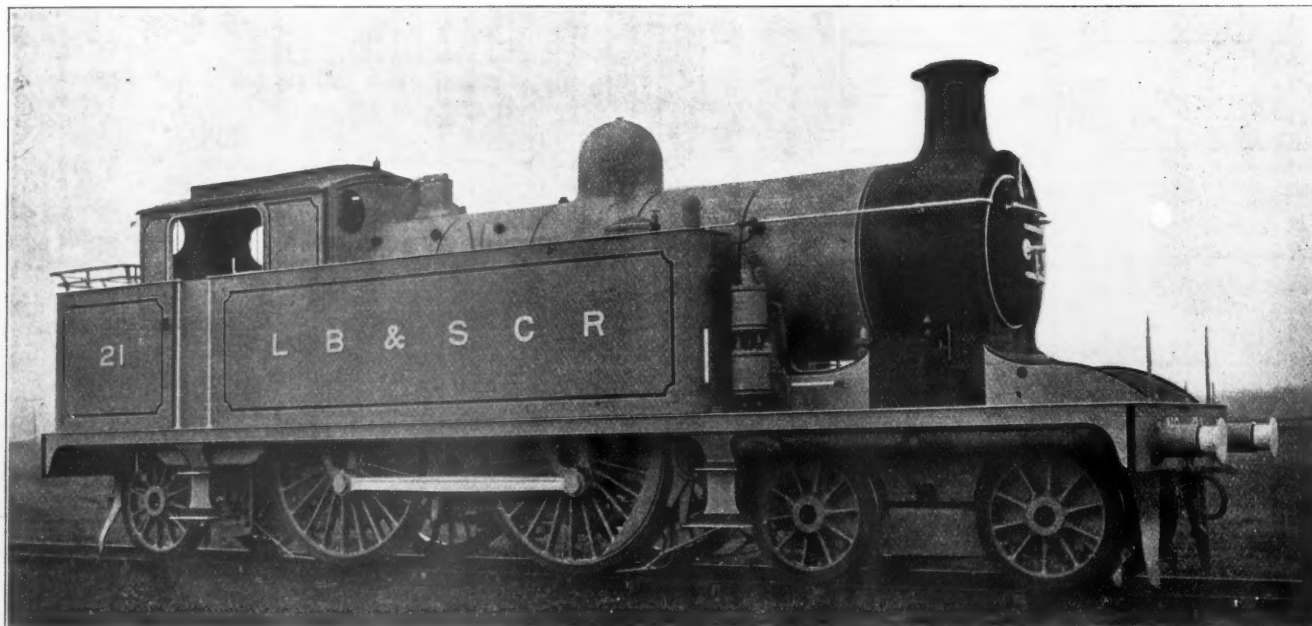


LARGE TANK LOCOMOTIVE; LONDON, BRIGHTON & SOUTH COAST RAILWAY.

Some large new tank locomotives of the 4-4-2 type have been designed by D. Earle Marsh, Locomotive, Carriage and Wagon Superintendent of the London, Brighton & South Coast, and by the courtesy of that gentleman we are enabled to illustrate one of their engines herewith. The engine is practically the equivalent of an express passenger engine, its dimensions and general characteristics being fully in accordance with the requirements of fast passenger traffic, and its capabilities are only limited to the performance of shorter distance runs because of the absence of a tender in which to carry supplies of water and coal in quantities sufficient for long runs without stopping. Engines of this description are able to deal with any of the expresses of normal weight running between London and Brighton for instance, and can attain speeds equal to those reached by the larger and heavier locomotives with tenders. The great handiness, ability to run in either direction without turning, and with equal facility, and the reduced total weight but practically identical ad-

Weight on coupled wheels38 tons
Weight of engine in working order73 tons
Tractive effort17,729 lbs.

Weight on drivers	=	4.80
Tractive effort		
Total weight	=	9.22
Tractive effort		
Tractive effort x diameter of drivers	=	884.81
Heating surface		
Heating surface	=	67.62
Grate area		
Firebox heating surface	=	7.76*
Total heating surface		
Weight on drivers	=	52.51
Total heating surface		
Total weight	=	100.75
Total heating surface		
Displacement, 2 cylinders, cu. ft.	=	8.53



Tank Locomotive for the London, Brighton & South Coast.

hesion weight are advantages which commend the introduction of this type of engine for shorter distance express service in England. The employment of this type of engine is especially suited to a line like the Brighton, where a continuous and fast service has to be maintained between London and a seaside terminus only 50 miles distant. The engine has inside cylinders and Stephenson link-motion valve-gear. The piston type of valve is employed working underneath the cylinder and at an angle of 1 in 9½ in. The engine is equipped with Westinghouse brake appliances; steam sanding gear, both fore and aft of the coupled wheel base, and other modern fittings. Its principal dimensions are as follows:

Cylinders, diameter	19 in.
Piston stroke	26 "
Wheels, bogie, diameter	3 ft. 6 "
" coupled, diameter	6 " 9 "
" trailing, radial	4 " 0 "
Wheelbase, bogie	6 " 3 "
" coupled	8 " 9 "
" total	30 " 11 "
Boiler, length of barrel	10 " 9 ½ "
" diameter	4 " 10 "
" height of center above rails	8 " 4 "
Working pressure	180 lbs.
Heating surface, tubes (315) 1 ¾-in. diam.	1,499 sq. ft.
" firebox	126 "
" total	1,623 "
Grate area	24 "
Water capacity of tanks	2,110 gals.
Coal capacity of bunker	3 tons.

Total heating surface	=	190.03
Displacement, 2 cylinders		
Grate area	=	2.81
Displacement, 2 cylinders		

*Per cent.

The above dimensions show the engine to be practically the equivalent in all important respects of the same company's standard 4-4-0 type express locomotives with tenders; indeed, the adhesion load with tanks full is five tons more than in the case of those engines. Most of the proportions are identical, thus warranting the use of the term express tank locomotive which has been applied to the new engine. Ten more of these locomotives, with horizontal cylinders and Schmidt superheaters are at present building at the Brighton Works.

The Austrian Railroad Minister has directed that on the State Railroads and a number of private railroads all locomotives which haul trains at a speed of 31 miles an hour or more be equipped with automatic speed recorders. The reason assigned is that many accidents are caused by exceeding the speed permitted by the regulations, which excessive speed can rarely be proved.

COMPENSATED LOCOMOTIVES.*

BY HERBERT T. WALKER.

III.

We will now take up engines falling under the third and last heading of our classification, namely, two-cylinder locomotives with double pistons in each cylinder. Although these were the most complicated of all they worked with a measure of success and their designers were most ingenious men, who were, in common with many others, far in advance of the requirements of their day.

The inventor of the four-crank, two-cylinder locomotive was John George Bodmer, a native of Switzerland, who was born in 1786. He was one of the most prolific inventors of his day and originated not only the balanced steam engine at the period when Stephenson's "Rocket" was only five years old, but many inventions in cotton spinning machinery, machine tools, rolling mills, air pumps and breech loading cannon, which are all, in some modified form, in use at the present moment. He was a man of extraordinary industry, but, disliking publicity, his name and achievements seldom got into the papers, technical or otherwise. As far as the writer can

were dispensed with, "whereby the rocking or oscillating motion attending locomotive engines as hitherto constructed is considerably diminished, and greater steadiness of motion obtained, as by this arrangement the momentum of one piston, together with its cranks and other connections is at all times exactly balanced or nearly so by that of the other, in consequence of the approaching or receding of the pistons to and from each other being always simultaneous."

Ritchie did not build an engine until about seven years after he obtained his patent, when *The Engineer* (London) of January 4, 1856, published a woodcut and description, with the editorial announcement that "Mr. Ritchie presents his engine to the world for the first time to-day. We saw her with steam up at Kew last week, but we would much rather see he fairly tried on the metals."

Fig. 9 is a side elevation of this engine. Its chief dimensions were: Cylinders, 12 in. diam. by 36 in. stroke, each piston having a stroke of 18 in.; wheels, 72 in. diam.; wheel base, 17 ft. long.; weight, about 25 long tons.

By reason of the centrally-located cylinders, coupling rods were inadmissible, but as it was necessary to keep the pistons always in their proper relative positions, Ritchie designed parallel motions, the two sets of which were connected by crossed

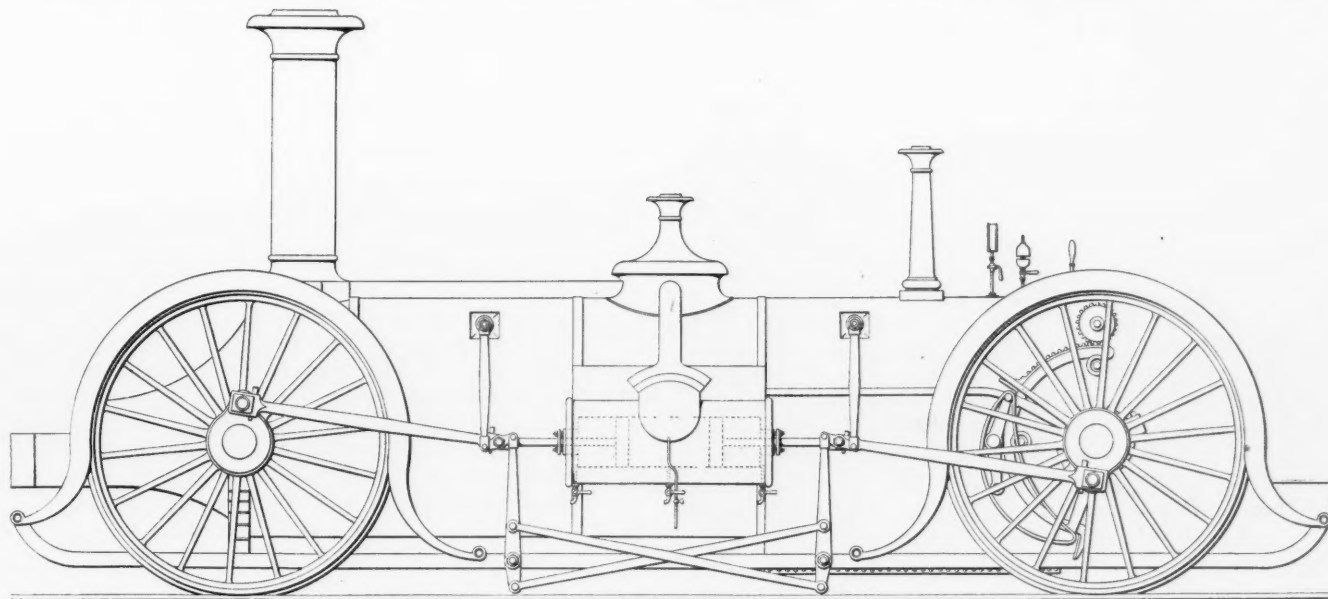


Fig. 9—Ritchie's Double Piston Engine, 1856.

ascertain, no drawings of Bodmer's locomotives have been published, and when writing the present article it appeared that a mere description of his engines would have to suffice; but by means of diligent search, occupying about two years, members of the Bodmer family were finally communicated with, and by their courtesy, the writer has had the use of all of Bodmer's remaining drawings and diaries.

As the Bodmer engines were in a class by themselves and the publication of the matter will form the most important contribution to locomotive history in recent years; and moreover, as the diaries give an insight into Bodmer's life and character, it has been thought best to publish the material as a monograph at some future time. Therefore, these notes will be concluded with a description of the only double piston locomotive the writer ever saw, and although it was a mechanical failure, its history should be recorded, for it is reasonably certain that no other engine like it was ever built.

The engine in question was designed by Charles Ritchie, of Aberdeen, who obtained a British patent on March 2, 1848. Ritchie repeated Bodmer's double piston arrangement but he placed the cylinders midway between the driving wheels, so that each piston actuated a separate crank, and coupling rods

rods as shown. Thus in his attempt to dispense with coupling rods, which he considered objectionable, he introduced a vicious parallel motion which alone would have condemned the engine for practical use; but as regards the balancing of the reciprocating parts, this locomotive is worthy of study, for the cylinders were at about the engine's center of gravity, and the tensional strains acting from the cylinder centers in each direction were equal and opposite between the center of each axle box. The total effect on the whole frame would therefore be one of equilibrium. The axles had their cranks so arranged that when, as shown in the drawing, one was at the top half stroke, the other was at the bottom, with the cranks on the other side of the engine at right angles thereto and opposing each other. Supposing the engine to be in the position shown in the drawing and steam admitted to the center of the cylinder, the pistons would be driven apart and the engine would travel forward. Cross-head thrust was divided, and simultaneously opposite on the same side of the engine. In the connecting rod piston shown, the front cross-head thrust would be downward, and that of the rear cross-head upward. This would have a racking or twisting effect, but with a properly designed frame it would not be serious.

This locomotive had the superior turning moment of a

*Copyright, 1908, by Herbert T. Walker.

modern four cylinder balanced engine with the driving effort distributed over two axles. Some of the details of this engine should be noted, as they throw side lights on the history of the locomotive. Ritchie was one of the many advocates of the low boiler theory; hence his engine had the boiler hung between the axles which gave a very shallow firebox, but it had four transverse water tubes just under the crown sheet which added about 28 sq. ft. to the heating surface. The boiler was fed by a small steam pump beneath the foot plate; this pump was automatically started and stopped according to the water level in the boiler. Steam was taken from a shallow dome and from thence through pipes inside the boiler to the valve chests, which had slide valves "formed like inverted cones, the exhaust passage passing upward through the center of the valve," and thence up through outside pipes to a rectangular passage on the top of the boiler to the stack. The valve motion was a single fixed eccentric having two blades and a large link, which engaged one of the two ends of a double rocker arm for the purpose of reversing. A similar gear was used by Baldwin 20 years previously. Ritchie moved the link by a segmental rack and pinion, as will be understood by the drawing. There were two directly pressed spring safety valves. The one on the dome was a species of pop valve, having a flat bearing surface recessed vertically into the valve seat. Ritchie stated that "the moment this valve was moved, the steam had access to the enlarged surface, which was the same in effect as if one half the weight was taken off the valve." The cylinders were bolted to the boiler, and the only framing the engine had was made of sheets of plate iron riveted to the smokebox and firebox, which formed pedestals for the driving boxes. These two sets of frames were connected by a narrow plate frame running the total length of the engine and to which were fulcrumed the equalizing levers of the parallel motion. This frame also helped to support the heavy wheel guards which were lined on the inside with alder wood, so that in the event of an axle breaking, the wheels would be kept upright on the rails by the wheel guards which would also act as brakes. The trailing axle had the usual springs, but the leading axle had one transverse spring. The pistons and their rings were of gun metal and the piston rods of cast steel. How the pistons worked when they were heated by the steam is not stated, but they probably gave trouble.

We are not told where this engine was built, but it is quite likely that Ritchie built it himself, for an examination of the London Directory of 1855 shows that he was a mechanical engineer, located at Dowgate Wharf, Canal Road, Kingsland, on the banks of the Regents' Canal, where there were several foundries and machine shops, as the writer remembers. From thence the engine could have been conveyed by barge to the Thames river and so to Kew, where it was tried under steam as described. There is no evidence that it ever did practical work, or even traveled on rails, for in the early 60s, when the writer was a boy, he saw this engine in the stable yard at a tavern at Kew Bridge, and, in company with other boys, played "engine driver" on it several times. At that period it was partially dismantled and fast rusting away, with its wheels deeply sunk in the ground. The landlord of the inn could give no information concerning it, as it was there before he came into possession of the premises, and indeed, the only thing he cared about the engine was that it was occupying space that should have been available for the carriages of his guests.

What became of Ritchie's engine the writer knows not, and it is unlikely that further particulars will ever be obtained, for recent inquiries directed at Kew have failed to elicit any information, and it only remains to be said that the drawing illustrated in Fig. 9 has been made from the imperfect woodcut originally published in *The Engineer* with some parts added from the writer's recollection of the engine.

In reviewing this more than half forgotten field of locomotive history, it must be conceded that our predecessors gave attention to the counterbalancing of locomotives. Granting

that some of their ideas were impractical from the modern standpoint, it appears that they were not altogether so, and a few of them might be worthy of repetition—in fact some of them have been repeated as readers of this journal are aware. As a rule, inventors seldom reap the due reward of their efforts. The writer is acquainted with some eminent inventors who were wholly unable to get their designs adopted during the term of their patent rights, but to-day we are enjoying the fruits of their unrewarded labors. The early inventors of balanced locomotives were regarded as "cranks." So were they who gave us the superheater and feed water heater. The opponents of these devices have held that the results were not commensurate with the initial and subsequent outlays involved, yet they are in use to-day with advantage. It is to a great extent a matter of opinion (or prejudice) among engineers as to whether refinements of design are practical in a locomotive engine, for motive power superintendents hold opposite views in these matters, and as a class they are slow to adopt new ideas—perhaps from unwillingness to involve their employers in costly experiments which, in case of failure, would tell against them. Similarly, it is difficult for inventors to obtain a hearing among firms of locomotive engine builders, who, as a rule, are unfavorable to designs not emanating from their own staff of engineers. It was but a few years ago that the balanced locomotive met with strong and even contemptuous opposition, but to-day opinion has changed.

Among the examples of engines herein noticed, those with the intermediate driving shaft appear to be worthy of a re-trial. There can be no question about the easy running of Crampton's engines, for the centrally located power shaft in fixed bearings has obvious advantages, and a four-cylinder side lever engine might be built similar to Mr. Prince's design, or those shown in diagrams E, or F (Fig. 1). Or, an intermediate crank shaft with a revolving cross-head (Figs. 4 and 5) could be built and tried under modern conditions. This plan seems to be the only way to neutralize the effects of upward or downward cross-head thrust. This design, with four cylinders, has been recently patented.

The reason why some of the foregoing engines were short lived is that against complication the old-time motive power superintendent set his face like a flint, and it is only lately that engineers have been disposed to concur with Professor Goss who has remarked that "if by increasing complication a necessary function can be better performed, then it may often happen that danger of derangement is lessened, and the action of the whole machine is actually improved."

The writer is greatly indebted to the late M. N. Forney for his kindly and practical interest in this monograph, which he much desired to see published. The courtesy of Edgar Worthington, Secretary of the Institution of Mechanical Engineers (London), is also gratefully acknowledged, and without the hearty co-operation of W. B. Paley, of London, the present article could never have been written.

The prizes awarded by the German Railroad Union under its offer of March, 1906, were announced in June last as follows:

To Wilhelm Schmidt, 7,500 marks for smoke tube superheater.

Three thousand marks each to Johannes Grumme, of Bochum, for switch with spring points; to Herr Kuttruff, of Karlsruhe, for jack for raising cars, especially cars on trucks; to Herr Krittell, of Stuttgart, and Herr Wintergerst, of Esslingen, for superheated steam motor cars for railroads; to Professor Oder, of Danzig-Langfuhr, and Professor Goering, of Berlin, for their treatise on the "Arrangement of Stations."

Fifteen hundred marks each to P. Joosting, Bridge Engineer of the Netherlands State Railroads, for design for unsymmetrical drawbridge; to Herr Adelsberger, of Breslau, for locomotive spark arrester; to Herr Enzlin, of Stuttgart, for

simplified method of despatching freight; to Herr Köhler, of Cologne, for plans of freight accounting among German railroads; to Professor Seidler, of Vienna, and to Herr Alexander Freund, of Vienna, for their treatise on "Railroad Rates in Their Relations to Commercial Policy"; to Professor Oder, of Danzig-Langfuhr, and Dr. Blum, of Berlin, for their treatise on "Stations"; to Herr Scheibner, of Berlin, for his work, "Manual of Mechanical Safety Switches."

THE THEORY OF RAILROAD RATES.

BY WILLIAM Z. RIPLEY,

Professor of Economics, Harvard University.

I.

Analysis of the theory of railroad rates begins naturally with a study of the nature of railroad expenditures. Neither a railroad nor a factory can earn money until it has first liberally expended it. For, in the first place, a physical plant must be provided, which means the guarantee of interest on a large capital; and secondly, it must be operated often unprofitably at the start. This is especially true in a new and undeveloped country like the United States, where demand for transportation must be oftentimes created by making virgin territory accessible to large consuming markets. Twenty years ago the analysis of railroad expenditures with any approach to precision, owing to the absence of scientific data, would have been impossible. A few companies, such as the Pennsylvania, the Union Pacific and the Louisville & Nashville, had indeed attempted to systematize their accounts, but there was no agreement as to details, despite a certain harmony in questions of principle. But since the passage of the Act to Regulate Commerce in 1887, and largely owing to the work of Prof. Henry C. Adams, as statistician to the Interstate Commerce Commission, the matter may now be examined profitably in detail. The data is published annually in a volume entitled "Statistics of Railways in the United States." The amplified powers of the Interstate Commerce Commission since 1906 have considerably changed the system in force since the original law of 1887; but the general principles remain unchanged.* One feature of the new law, however, is important. Not only must detailed reports be periodically and promptly made, no company is now permitted to keep its books in any other form than the one officially prescribed. This form was adopted after extended conference with the Association of American Railway Accounting Officers, which body has, in fact, officially approved of the form adopted in most regards. These accounts therefore may be said to represent the combined intelligence of the practical and theoretical analysts, of the operating and financial staffs and of the governmental supervisory board. A great impetus to scientific railroad operation has undoubtedly resulted from this co-operation between government officials and private managements.

The primary distinction in railroad expenses is between those which are constant and independent of the volume of traffic, and those which vary more or less directly in proportion to it. Thus, of the total outlay, it may at once be premised that for a time at least certain capital expenditures are entirely unrelated to the volume of business transported. Interest on bonded indebtedness is neither increased nor diminished, up to a certain point, by the number of tons of freight moved; whereas, on the other hand, other items of expenditure, such as wages of train hands and fuel cost, are more or less directly affected. The distinction above mentioned finds its clearest expression in the primary division of railroad accounts into so-called "operating expenses," which are variable, and "fixed charges," which, as the name implies, are constant. Much of the direct wear and tear of equipment belongs to the first class, while, as we have said, interest on its own

funded or floating debt, together with capital obligations on leased lines, naturally fall into the second group. This second class of constant expenses, which along with taxes is often denominated in railway reports as "Deductions from Income," is a relatively large one. Thus, in 1905, out of a total expenditure by all the operating railroads of the United States of \$1,910,000,000, no less than \$520,000,000, or about 27 per cent., consisted of constant or fixed expenses. This proportion of absolutely fixed expenditures, moreover, shows a remarkable constancy throughout a series of years. It reached high-water mark during the hard times in 1895, at 33.07 per cent. of all outlay. Indebtedness had accumulated unduly, while at the same time the volume of traffic was so small that mere operating expenses dwindled in proportion. But since that time, largely as a result of the financial reorganizations of 1893-7, the percentage of fixed charges has reached its present low point. This improvement is also in part due to the growth of traffic, and thereby of operating expenses. The latter have indeed grown faster than the accumulation of debt, owing to the practice, prevalent among American roads, of paying for many improvements and additions out of surplus income, rather than by charging them to capital account; that is to say, by borrowing money to pay for them.

Having at the outset deducted approximately one-quarter of our total expenditures to meet fixed charges, we may now proceed to analyze those outlays which remain. And this is to be done, always keeping in mind the fundamental distinction between constant and variable items. From 1887 until 1906 the operating expenses of American railroads have been allocated in the four following groups:

- (1) Maintenance of Way and Structures;
- (2) Maintenance of Equipment;
- (3) Conducting Transportation;
- (4) General Expenses.

This grouping under the new law of 1906 has been somewhat re-distributed. But inasmuch as all the statistical data as yet available is presented under the above-named heads we shall adhere to that classification. This we may the more properly do, as our object is to show the general bearing of railroad expenditures upon rate-making, rather than specifically to analyze cost accounts. For this simple purpose the above arrangement is entirely adequate.

The general nature of each of these groups above named is roughly expressed by its title. Under the first, Maintenance of Way, are segregated those outlays which have to do with the up-keep of the roadway and permanent structures in proper shape for the moving of trains. It includes, besides such obvious items as ballast, rails and ties and the wages of track men, every outlay on permanent structures, such as bridges and tunnels, stations, grain elevators, stock pens, gas, oil and water tanks, and even scrap bins and eating houses. To these are added scores of other minor items, such as maintenance of telegraph lines, fences and cattle guards, signal plants and docks and wharves. Every kind of tool or appliance used, and all wages paid in connection with the maintenance of this part of the property are included. Insurance and even the legal costs and damages, incurred in connection with accidents, are all assigned to the appropriate property. The second group, Maintenance of Equipment expenses, includes, as the name implies, the proper care and preservation of all the rolling stock in good working order. Repairs and renewals of all locomotives, cars and vessels, form the largest single items. But all shop machinery and power plants are included, with specification in detail of every appliance needed in connection with the work, as for example, over 150 possible items from "adze handles, ammonia and auger bits" down to "wire brushes, wrenches and zincs." Conducting Transportation expenses, the third group, are supposed to provide for the actual movement of traffic. The two former classes of expenditure having put the fixed plant and rolling stock in condition, it remains to operate the property. Under this head is chargeable all costs of coal and supplies, wages of train hands

*2 Quarterly Journal of Economics, May, 1908, page 364.

from enginemen to car porters, yard, station, switch and signalmen and telegraph operators. To these are added such items as "purchased power," "cleaning cars," "clearing wrecks" and "losses and damages"; in short, every conceivable item of expenditure which can be assigned to the service as distinct from the mere property.

A fourth group of expenditures remains, denominated General Expenses. This includes all salaries of principal administrative officers from the president or receiver down to the real estate and tax agents, together with all their allowances for expenses, special cars or trains and the like. All clerical salaries in the general offices naturally belong here, as well as most of the legal expenses, outlay for pensions, relief departments and the like.

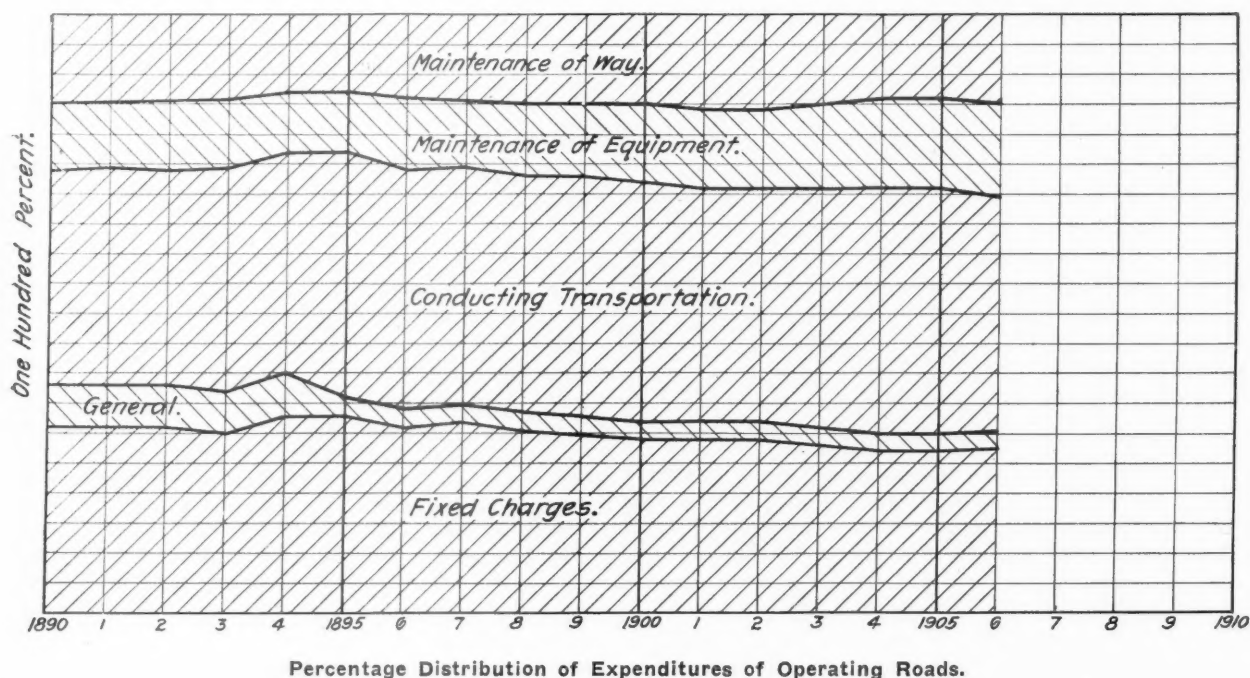
A distinct improvement in the matter of principle has been made in the revised classification of operating expenses under the new law of 1906, by the segregation of a fifth group, denominated Traffic Expenses. These cover all the work of soliciting business, making rates and accounting for freight and passenger traffic. Such outlays were formerly grouped in the main under conducting transportation, but as is plainly evident they are distinct in their nature from the expenses incidental to the actual handling of trains. Administrative railroad organization has long recognized the peculiar and important nature of this work, by constituting it as a separate department, usually headed by one of the vice-presidents of the road. The main items under this grouped head are salaries and expenses of a large staff of officers and clerks, such as general passenger and freight managers, agents and traveling solicitors; rents and care of offices at home or abroad; advertising, membership in traffic associations, immigration and industrial bureaus, expenses for experimental farms, field demonstrators, donations to expositions, fairs and stock shows—everything in brief which tends to create or keep business, to be afterward actually handled by the transportation department.

provided, the details of which, however, need not concern us at this time.

The following table based upon the returns for 1905 shows the relative importance of the principal items under railroad expenditures grouped under the proper headings:

	Per cent. of operating expenses.	Per cent. of total expenditures.
Maintenance of way and structures	19.78	14.39
Repairs of roadway.....	10.39	
Renewals of rails.....	1.3	
" of ties.....	2.66	
Repairs, etc., of bridges, etc.....	2.32	
" " buildings, etc.....	2.11	
Maintenance of equipment.....	20.76	15.09
Repairs & renewals of locomotives.....	8.29	
" passenger cars.....	1.97	
" freight cars.....	8.20	
Conducting transportation.....	55.49	40.36
Engine and roundhouse men.....	9.4	
Fuel for locomotives.....	11.28	
Train service (wages).....	6.54	
Switchmen, flagmen, etc.....	4.34	
Station service.....	6.44	
General expenses.....	3.96	2.90
Total operating expenses.....	100	
Fixed charges.....		27.23
Total—all expenditures.....		100

In the first two columns the percentages given relate to the operating expenditures alone, without reference to the total expenses—eliminating, that is to say, the large group of fixed charges, and treating these operating costs entirely by themselves as if the others were non-existent. In the third or right-hand column, it will be observed, the main groups are again given in percentages, not of the operating expenses alone, but of the total outgo, including capital expenditures in the nature of fixed charges. It should also be noted, of course, that only a few of the large or more important items are here included, and in the right-hand column no details, other than for the four main headings, have been computed. The constancy in the distribution of these groups of railroad expenditures over a term of years is graphically shown by the succeeding diagram. The perpendicular line for each year is



ments. In future the detailed official statistics will segregate these expenses; but at the present writing and in statistics down to 1906 they must be bulked in with conducting transportation. An important modification in accounting under the new law of 1906 has also been made in respect to depreciation charges. Heretofore the practice of companies varied widely, as will hereafter be shown. Under the new rulings a definite and uniform system of charging off for depreciation has to be

divided proportionately to the relative importance of each designated item of expense for that year. Thus the course of the horizontal lines, dividing the four main percentage zones, represents the ups and downs in the relative importance of each item. Occasionally, as in the years following 1895, the proportion of so-called general expenses decreased appreciably, but in the main all the items moved more or less in unison subject to the movements of wages and prices. This

relative constancy proves how fundamental the arrangement of groups is.

The attempt to differentiate the constant from the variable expenses of railroads on the basis of the preceding operating statistics may now be made. What proportion of each item in the table for each of the large groups is fixed in amount; and what proportion fluctuates more or less in connection with the volume of traffic? Under maintenance of way and structures, absorbing about one-fifth of operating expenses, over one-half is incurred for so-called "repairs of roadway." It is evident that a large part of this expense is due not to wear but to weather. A costly plant is exposed to every vicissitude of flood, fire and waste. Reballasting and realignment may be somewhat more expensive where traffic is heavy; but certainly all general repairs, the wages of track walkers, the removal of snow, ice and weeds, must be attended to entirely irrespective of the number or size of passing trains. Of the second item, renewals of rails, it is probable that this expenditure is directly traceable to wear and tear in large part. The more trains, the heavier the locomotive and cars, or the higher the speed, the more rapidly must these rails be replaced. But even so the proportionate amount is small, constituting generally between 5 and 10 per cent. only of the group expenditure for maintenance of way. With ties, an item about twice as important as rails, the case is exactly the reverse. Ties rot out rather than wear out. They have a natural life varying from four to 14 years, as influenced by climate, ballast and drainage. The necessary expenditure per mile for them by different roads varies greatly, as might be expected; but it seems to bear little relation to the density of traffic. As for the principal remaining items under Maintenance of Way, such as repairs of bridges and buildings, if properly designed to withstand their loads and strains, most expenses of their up-keep such as repainting and reroofing should be practically independent of the volume of business. A recent elaborate discussion of these matters in 1907 in the Wisconsin Two-Cent Fare decision reached the conclusion that all of the cost of rails, one-third of the ties and 10 per cent. of expenditures for roadway, track and bridges, are all that can properly be charged to wear from traffic, as opposed to natural depreciation. Acworth illustrates this point by comparison of the Midland & Great Western Railway of Ireland and the Lancashire & Yorkshire Railroad. These two are of about equal length, approximately 530 miles. The latter carries 40 times the traffic of the former road, and yet its expenses for maintenance of way are only eight times as much. It seems safe, in general, to conclude that in this first large group of expenditures for maintenance of the fixed plant, probably not over one-third are variable to any considerable degree. Acworth for England estimates this proportion at about two-fifths.

The proportion of variable expenditures in the second group for Maintenance of Equipment is probably higher than in that of maintenance of way. This is due to two causes. Rolling stock is, of course, subjected more directly to wear and tear in service than are bridges, cuts and fills and buildings. Rolling stock, moreover, is susceptible to change of type and improvement. Its effective life is thus shortened both by use and by replacement. Before being worn out it may have become antiquated. More powerful locomotives and larger cars suited to new requirements of the business may necessitate scrapping otherwise good equipment. This very fact, however, imposes upon the management the need of intensive service while it lasts. All the mileage possible must be extracted from each vehicle before it goes out of date, and this implies a higher proportion of wear-out than of mere rust-out. Yet the fact is still true that many of the items in this class are unaffected by the mileage or tonnage performance. There is little difference in wear on a freight car as between light and moderately heavy loads; and as for passenger cars, the actual wear assignable to the paying load is a negligible quantity. We may, at all events, risk an estimate in the statement

that probably not over half of all the expenditures of a railroad for maintenance of equipment vary with the volume of the business.

The direct effect of a changing volume of business is most clearly seen in the third group of operating expenses, having to do with conducting transportation. This is very important, comprising as shown by our table on page 304 no less than 55 per cent. of operating outlay and 40 per cent. of total expenditures including fixed charges. At first glance it would appear as if at last one had here to do with a direct relativity between cost and volume of business. Surely the cost of fuel for motive power will vary with the tonnage moved. This item, amounting in 1905 to no less than \$156,000,000 for the railroads of the United States was the largest in the budget, constituting 11 per cent. of all operating expenses. Yet brief consideration shows that even here much of this expense is constant and invariable. A locomotive will burn fully one-third as much coal merely to move its own weight as to haul a loaded train. Five to 10 per cent. of its total daily consumption is required merely for firing up to the steaming point. Twenty-five to fifty pounds of coal per hour go to waste in holding steam pressure while a freight train is waiting on a siding. Every stop of a train going thirty miles per hour dissipates energy enough to have carried it two miles along a level road. In brief, expert evidence shows that of this important expenditure for coal, from 30 to 50 per cent. is entirely independent of the number of cars or the amount of freight hauled. The largest wage items in this group of conducting transportation expenses are for engine and round-house men, and conductors and brakemen. This expense is, of course, even more independent of the volume of business than the cost of coal. No more engine men or conductors are needed for a heavy through express or freight train than for a single car train on a branch line. And the extra cost for service of more brakemen as the size of the train increases is relatively unimportant when modern equipment with air brakes is used. Appreciation of this fact is largely responsible for the great increase in train loads in recent years. Train-mile costs can be economized most effectively by distributing the wages of a train crew over as large a tonnage as possible of paying freight. As for the wages of station men, switch and flag men, they are largely and often entirely independent of the amount of business. From all these considerations, it appears that at a conservative estimate, no less than 50 per cent. of the cost of conducting transportation constitutes a fixed charge upon the property once it is in operation, irrespective of the volume of business transacted.

The group of general expenses which alone remains for analysis is relatively small in amount. It is obvious that these outlays are a constant burden but slightly influenced by the variation in traffic. Salaries may indeed be reduced somewhat during hard times—a few clerks may be laid off, but on the other hand, this being an expense of organization, the general staff must be maintained at about a certain standard of efficiency regardless of business.

Summarizing our estimates thus far, we may reconstruct a table, distributing expenditures according as they are constant or variable in somewhat the following way:

	Per cent. of operating expenses.			Per cent. of total expenses.		
		Constant.	Variable.		Constant.	Variable.
Maint. of way....	20	13.4	6.6	15	10	5
" " equipm't.	20	10	10	15	7.5	7.5
Conducting transp.	56	28	28	40	20	20
General expenses..	4	4		3	3	
	100	55.4	44.6			
Fixed charges				27	27	
				100	67.5	32.5

Thus one arrives at the general conclusion that approximately two-thirds of the total expenditure of a railroad and more than one-half of the actual operating expenses are independent of the volume of traffic. The remaining third of all expenditures, or what amounts to the same thing, the other

half of the operating expenses are immediately responsive to any variation in business. Applied to the railroad net of the United States, this means that only about one-third of the \$2,000,000,000 disbursed in 1905—an amount equal to about two and one-half times the national debt—is susceptible of variation according as the traffic expands or decreases. This provisional estimate, defective principally because of inadequacy of the returns as to depreciation and replacement, agrees in the main with computations based upon other data. The Vice-President of the Southern Pacific Railroad, in 1892, after extended investigation, arrived at precisely the same general conclusion. The great German authority, Sax, estimates that one-half of a road's operating outlay is constant and that this operating outgo equals about half the total expenditure, the other half being capital cost and hence constant. This calculation places the constant factors even higher than ours, viz.: at about three-fourths of the total expenditure. Eaton states that half of the operating expenses respond to changes in the volume of traffic. Our estimate above mentioned seems to be in accord therefore with good authority, and differs but little from any of the reliable writers.

It should be observed in passing that the relative distribution of outgo above mentioned varies greatly both as between different railroads and, on the same road, as between different years. During lean seasons the necessity of reducing expense generally induces the heaviest inroads on expenditure for maintenance of way. Nearly one-third of these expenditures can probably be postponed for short periods without serious detriment to operation. On the other hand, the cost of moving each train, that is to say, the outlay for fuel and wages cannot be greatly cut, although some discontinuance of freight trains may take place. The most readily postponeable outlay is therefore found in the department of maintenance of way. Two hundred ties per mile may be annually renewed instead of twice that number for a year or two. Heavy decreases in the wage account for road and track men may be effected, sometimes at the cost of public safety perhaps, but none the less effectively from an immediate fiscal point of view. A series of hard years thus always results in heavy proportional curtailments of maintenance of way expenses. In 1895, for instance, midway between the two worst years of the depression of 1893-7, only 19.82 per cent. of operating expenses was devoted to maintenance of way, with 15.76 per cent. expended for maintenance of equipment. Six years later in the full tide of prosperity the outlay for maintenance of way had risen to 22.27 per cent. With over 350,000 freight cars idle on sidings, as during the spring of 1908, expenditures on repairs of equipment may temporarily be postponed. Depreciation rather than wear takes place. An economy of about 5 per cent. may temporarily be effected in this wise. It is only with the return of prosperity that the temporary postponement of this expenditure makes itself felt. Economy at the expense of efficiency is poor business policy in the long run. With the revival of activity on the other hand, as in 1898, there may be witnessed a sudden concentration of the postponed expenditures of the preceding years. The Illinois Central was spending \$1,500 per mile on maintenance of way in 1905, as against only \$1,150 in 1897. A succession of fruitful years may however find the property so thoroughly kept up that some measure of relaxation in expenditures may ensue. During these good years with heavy traffic, it is the maintenance of equipment charges which tend to rise. Locomotives and cars are constantly in need of repair owing to hard usage. This was a noticeable feature during the four years after 1900. The Illinois Central expending only \$866 per mile for maintenance of equipment in 1897, laid out \$1,740 per mile for the same purpose in 1904.

Sometimes, as in January, 1903, or November, 1906, general wage increases all along the line take place. These, of course, affect all branches of the service. Supplies of all kinds may also enhance in price. It was doubtless the rise in the price

of coal which increased the proportionate importance of the fuel item in the railroad budget of the United States from 9.8 per cent. in 1900 to 11.8 per cent. in 1904. The tremendous rise in expenses of all kinds in 1907 was not at first appreciated because of the large volume of traffic. It was only when the sharp decline in business following the panic in October of that year took place that the full influence of this factor became apparent.

As between different roads also, the relative proportion of the various elements of cost will vary according to circumstances. Northern roads are exposed to heavy maintenance of way charges, owing to snow, ice and frost. In rugged districts or with heavy grades expensive operation is apparent in high conducting transportation expenses. On the Pennsylvania trunk line, rising to 2,100 ft. above sea level, and with many curves, the distribution of expenditures is quite different from that on the New York Central, which operates a straighter line at about water grade. On the Union Pacific movement expenses have been at times over 50 per cent. higher than on the St. Paul road, which operates in level country. It is a combination of high grades and poor equipment, which undoubtedly keeps the relative cost of conducting transportation so high on the Erie. The proportion of local to through business is of importance in this connection. Railroads like the Boston & Maine, or the St. Paul system before 1908, because they have so much local business, contrast strongly with others like the Chicago Great Western, the Erie or the old Fitchburg Railroad. On the latter roads the distribution of expenses is different, because their large volume of through traffic carried in bulk is so much cheaper to handle. Obviously, the expense incident to frequent stops and loss of time, as well as in loading and unloading local business, will be much greater than in long-haul trainload traffic. The cost of large items like fuel will vary greatly in different parts of the country from perhaps \$1.25 per ton for coal in Pennsylvania up to \$7 or more on the Pacific coast. Since the recent discoveries of petroleum in Texas and California, economies have been expected upon the Southern Pacific, which by comparison with Northern Pacific, still using coal, may be of great importance. More than six-tenths of the cost of locomotive service is for fuel, so that a reduction of cost from \$4 a ton to an oil equivalent at \$1 per ton may aggregate a large sum. It has been estimated that such a saving on 1,600,000 tons of coal would pay 5 per cent. on an additional capital of \$100,000,000. Similarly the character of the freight, whether it be like coal, iron ore or grain, cheaply handled, or merchandise which must be carefully housed and treated; its regularity, whether it flow evenly the year round like the dressed beef business, or as on the cotton and cattle range roads, is concentrated in a short season, and all moves in one direction; the relative proportions of freight and passenger business—in New England about on an equality, while in the West and South nearly nine-tenths freight, and finally the efficiency of management, in the use of rolling stock, making up trainloads and keeping all equipment busy, all of these factors will influence the proportionate distribution of expenditures. The operation of each road thus constitutes an interesting problem in statistical analysis by itself.

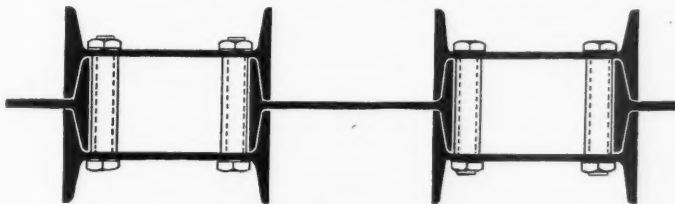
(To be continued.)

What a holiday may do for passenger traffic in Germany is shown by passenger earnings, which this year were 15 per cent. more in June than last year, Whit Sunday coming in June this year and in May last year. For the three months ending with June, passenger earnings were 2¾ per cent. more this year than last, but freight earnings 4¼ per cent. less. In June freight earnings were 6 per cent. less this year. The course of traffic in Germany has been similar to that here, but the changes have been less; when our traffic was increasing by leaps and bounds, German traffic was increasing by steps and strides; now when our traffic has fallen off mightily, German

traffic has fallen off seriously, but not nearly so much as ours—the difference between an old progressive and a new progressive country.

NEW USES FOR STEEL.*

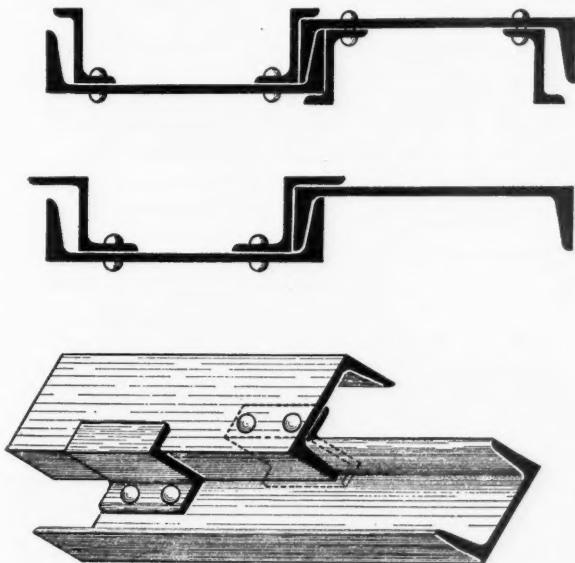
The purpose of this paper is to deal with the use of steel in building cofferdams, as it is under this method that there has come recently a most important line of the substitution of steel for wood. Although there are advantages in using wooden



Simon Patent Steel Piling.

sheet piling in this work, the disadvantages are many. The formation of tongues by strips spiked to the edge of the planks are poor substitutes for the tongues and grooves formed in a planing mill. Even at best, the tongues are easily split and leaks develop under water pressure, to prevent which the pile must be strengthened and braced so as not to be forced out of line. This bracing necessitates additional working space, and therefore additional expense in driving. There have been a number of improvements which have overcome in part the disadvantages referred to, but still other disadvantages remain.

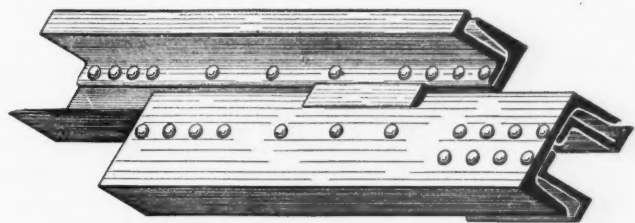
The attention of contractors was first turned to cast iron as a substitute for wood, and previous to 1822 a Mr. Mathews had used interlocking cast iron sheet piles in the foundation of the head of the north pier of the harbor at Burlington. In ignorance of Mr. Mathews proceeding, Mr. Ewart, in the same year, took out a patent for a new method of making cofferdams, using cast iron plates held together by cramps fitted to the dovetailed edges of the piles. These cast iron sheet piles



Friestedt Patents.

were used in England in dock and wharf work of some importance until 1824. Mr. Cubitt, in 1832, drove cast iron sheet piles, of his own design, 30 ft. long at the sea entrance of the Norwich and Lowestoft navigation. The following year Mr. Sibley built an iron wharf on the Lea Cut at Limehouse, with hollow cast iron piles connected by flat plates let down in

grooves on their sides. Finally in 1833-34 Messrs. Walker and Burges built, with cast iron piles, the quay wall on the river Thames in front of the East India docks at Blackwall, since named Brunswick wharf. The defects in cast iron, however, prevented its taking the place of wood, as there is need of a more homogeneous material of equal simplicity with wood, and superior to it in strength and reliability. Cofferdams of boiler plates were used on the Inch Garvie piers of the Firth of Forth bridge in 1884 and the steel caisson and steel cylinder piers have been in more or less extensive use since that time. This expense is justifiable only when the material is retained as a permanent part of the structure. The expense of the steel cofferdam, built of angles and plates, is due to the high cost of fabrication and erection. Furthermore, what the contractor requires is not a permanent structure but a set of tools that can be carried about from place to place and reused repeatedly and whose first cost is amply compensated for by the ability to do this. The first inventors of steel sheet piling little realized the various appliances to which their inventions might be put or that the conditions of the lumber market would become such as to make steel more economical than wood. Their first idea was to use steel in places where wood was not applicable. Lewis Dodge, for example, on May 17, 1870, proposed to use his tunnel lining in making cofferdams, filled with material, for artificial stone and extending sufficiently



Symmetrical Interlock Type.

deep into the hard bottom to protect against caving in when excavations were made. It was only when practical contractors saw the advantages of steel sheet piling as compared with wood that the inventions themselves were put to use in practices not originally contemplated. The credit for first doing so is due to the firm of George W. Jackson, Inc., which drove the first steel sheet piling in November, 1901, at the Randolph street bridge in Chicago, building in accordance with the Simon patent. The next contractor to profit by his first experience in sub-structure construction was Luther P. Friestedt, of Chicago. He took a step which seemed required in the development of the use of steel as applied to this work, and claims that his invention related to improvements in the building of docks, wharfs, sea walls, facing of sea walls, caissons, cofferdams, bulkheads and other submarine work of the same general character.

His ideas were taken up by other contractors and inventors, and it is said that as a consequence the records of the Patent Office at Washington are replete with designs for steel sheet piling, some of which merit careful consideration while others are absolutely impractical. Successful invention must necessarily be accompanied by actual experience, and in case of special sections, technical ideas can only be checked in the light of rolling mill practice. There are various types of steel sheet piling which have distinct peculiarities, advantages and disadvantages. The ideal sheet piling must possess strength. Inventors of what may be called composite steel piling, in which both wood and steel are employed, have overlooked the fact that the strength of a member is the strength of its weakest part. Strength in cofferdam construction is intimately connected with the whole subject of bracing, which has not yet been reduced to scientific form. Thin sheets of steel can only be economically used where the depth is not great and where the soil is loose, and yet there are inventors who advocate the use of practically plain sheets of steel $\frac{1}{8}$ in. thick,

*From a paper presented by R. B. Woodworth, M.Am.Soc.C.E., Engineer with Carnegie Steel Co., at a meeting of the Railway Club of Pittsburgh, April 24, 1908.

and claim that these can be driven more easily and correctly than 4-in. tongue and groove plank in any possible soil from quicksand to hardpan, also that they will not sustain any injury or distortion in driving and may be pulled and used again. In the case of this piling, it must be driven with a special wood follower. This, however, vitiates the fundamental idea of steel sheet piling. If it is necessary to destroy a large lot of timber in order to get sheets of steel into position, why not revert to our original wood construction? One advantage of steel is that it can be furnished in any weight or thickness desired. Steel sheet piling should be braced with judgment. It is rather clearly evident that under ordinary conditions a 33-lb. or 35-lb. piling up to 35-ft. lengths can be driven through almost any class of material, and that a 38-lb. or 40-lb. piling, up to 50-ft. lengths, can be driven and will successfully stand, with the proper interior bracing.

The strength of the material when interlocked in position may be different from its strength during driving just the same as in any ordinary building construction, in which final stresses may vary from erection stresses. The careful engineer will therefore select a material with a large radius of gyration and section modulus of the single pile. The construction of the piling should be such as to properly distribute the blow of the driving hammer, and if the material has to be pulled and reused, the tops must be protected from battering. This point is illustrated in the history of the Friestedt piling. It was found that the plain channel is only about one-quarter as strong as its adjoining member with two Z-bars riveted thereon, consequently a single Z-bar was riveted on each channel, making both pieces approximately of the same strength. The weight of the pile driving hammer was not equally distributed on the piling itself, the edge carrying the Z-bar being more able to resist the blow, as shown in the symmetrical interlock type. This gives a section that is practically symmetrical and in which the blow of the driving hammer is equally distributed over the head of the pile and in which a high degree of stiffness in driving has been obtained. This form of piling therefore probably represents the best

should be sufficient material here to take care of all such stresses. Three conditions which are indispensable in the use of steel sheet piling are strength in the interlock, stiffness in driving and strength when interlocked.

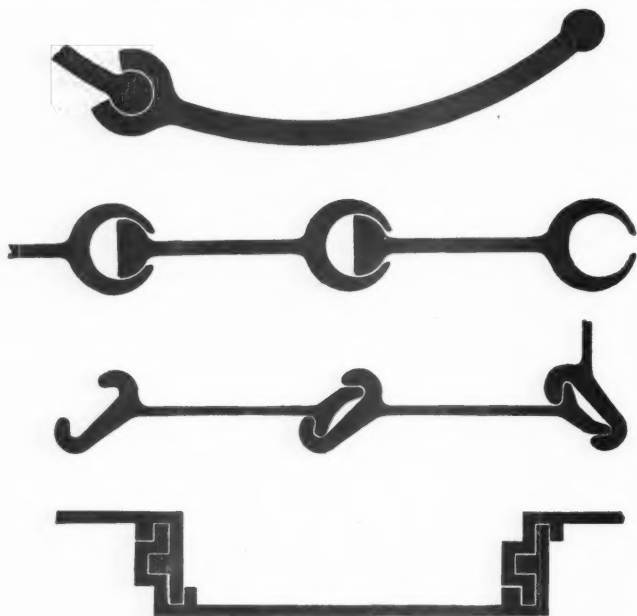
Another requirement to be considered is in the two features of economy, one that of direct comparison with wood and the other comparison of different forms of steel piling, some of which are the more economical from a rolling mill standpoint. The matter of economy in comparison with the cost of wood is not so much a question as when the use of steel sheet piling was first proposed. At the close of 1906, hemlock lumber cost just twice what it did in 1897; white oak, 39 per cent. more; white pine, 88 per cent. more; yellow pine, 78 per cent. more, and spruce 82 per cent. more, while steel had advanced but 38 per cent. above the cost of that year, which is recognized to-day as being about the bare cost of production. If the first cost of a single installation, therefore, is considered, the



Corrugated Interlock.

figures would to-day appear 50 per cent. or more better than when the originators of the steel piling industry first began to put it upon the market. As to the second point, that of the comparison of the different forms of steel piling, it may be said that a steel piling whose strength is high in proportion to its weight is most economical for ordinary purposes. The form of piling which requires special rolling mill equipment and whose manufacture is only attained at a high rolling cost has obviously the fewer commercial uses. The fact that certain forms of steel piling can be built up from structural material obtainable at most any good rolling mill or from warehouse stocks is a very large item in favor of these forms. Intricate interlocking systems, dovetailed and reversely bent forms, cannot long merit consideration.

The economical section should be one easy to drive, and looseness in the interlock is here indispensable. Material should go down easily. There have been sections rolled and put on the market which have failed as a commercial product by reason of not meeting this latter condition. The next requirement which must be considered, especially for subaqueous foundation work, is watertightness. The great gain in economy by the use of steel over wood in cofferdam construction is in the fact that but one wall is necessary with steel. The best types of steel sheet piling are practically waterproof under ordinary conditions of driving. The Friestedt interlock channel bar piling resists water pressure remarkably well, the fine particles of silt, gravel, etc., which are carried into the interlock form a water seal. In case of leaks developing, they may be easily stopped by the application of silt to the outside surface or by the use of oakum or other packing material on the inside. The United States steel sheet piling is practically waterproof also. It can be made completely so by driving down with the piling wooden packing strips in the interlock, which strips swell when in water, forming an effectual seal. A small quantity of piling has been manufactured and driven by Geo. W. Jackson, Inc., under the Simon patent for use in the contracting operations of this firm. It is only fair to say, however, that up to the present time the only types which have really been tried out in all classes of construction and under the most favorable, as well as unfavorable, conditions of driving, have been the Friestedt interlock channel bar piling and the United States steel sheet piling. It is interesting to note the types of construction in which steel piling has been used, which are: circular walls, cofferdams, core walls for dams, crib construction, culverts, building foundations, foundry curbing, loading slip, dock reinforcement, reservoirs, retaining walls, sea walls, sewers and subways.



Fabricated Beam Types.

that can be obtained in built-up sections for heavy driving. One of the advantages of the United States steel piling, covered by the patent of S. K. Behrend, December 26, 1889, the second of the fabricated beam types illustrated herewith, consists in the fact that all sections are perfectly symmetrical. Under conditions of unequally distributed earth and water pressure it is apparent that distortion in the alignment will naturally tend to create tension in the interlock, and there

General News Section.

Officers of the Canadian Pacific say that the company regards the strike as ended, so far as the Eastern and Ontario divisions are concerned. It is claimed that there is a sufficient force of workmen to meet all requirements in these divisions.

The Baltimore & Ohio and a number of other roads have followed their neighbors in entering suits in the Federal courts to enjoin the Interstate Commerce Commission from requiring the railroads to send in reports of infractions of the hours of labor law.

The Attorney-General of the state of New York has begun proceedings in the Supreme Court of the state against the coal carrying roads for maintaining a monopoly in the hard coal business, thus restricting production and regulating the prices of coal in New York. The defendants are the Lehigh Valley, the Lackawanna, the Reading, the Erie, the Ontario & Western, the Pennsylvania, the Delaware & Hudson, and companies allied with these in the coal traffic.

Assistant Attorney-General Pollard of Texas has rendered an opinion holding that railroads doing business in Texas may furnish to the Railroad Commission of Texas or to a member of the Commission a special train free of charge, for use in an inspection trip without a violation of the state anti-pass law. Mr. Pollard further holds that on such inspections the railroad or the commissioners making the inspection lawfully may invite guests to take trips without paying fares.

On certain divisions of the Pennsylvania Railroad changes have been made in the manner of promoting firemen to engineer. Heretofore firemen who failed to pass the examination for engineer were kept at the head of the list for promotions. Under the new rules the firemen will be given three examinations and if they fail to pass either of these they will not be included in the eligible list. Firemen who fail to pass the first examination will be given 30 days in which to prepare for the second and another 30 days to prepare for the final examination in case they fail to pass the second examination.

An officer of the Pennsylvania advises all division superintendents to investigate, through their auditing department, the extent to which shipments of freight are sent astray. Waybills of freight which has been found astray and is being sent free to its proper destination are, of course, filed in the auditing department, the same as other waybills, and by means of these the number and kind of errors may be traced. By running down all errors and showing up the delinquents, a good reduction could be made in the number of errors. This advice is based apparently on actual experience in correcting errors on the road named, and it is declared that efforts in this line will save considerable money to the company.

Two sweeping opinions reversing the lower courts were handed down by the United States Circuit Court of Appeals at St. Louis last Monday, sustaining the position of the Government in one feature of the safety appliance law in suits against the Atchison, Topeka & Santa Fe and the Denver & Rio Grande. By these decisions the Court of Appeals justifies Congress in abrogating the common law of "reasonable care." In the two cases decided, different grounds of defense were advanced. The Denver & Rio Grande case was argued before the lower court on demurrers, while the Santa Fe case was tried by a jury. The railroads won both decisions in the lower courts. The syllabus in the Santa Fe case lays down the new rule of law as follows: "The safety appliance law imposes upon a railroad company in the situations in which it is applicable an absolute duty to maintain the prescribed coupling appliances in operative condition and is not satisfied by reasonable care to that end."

As stated by the *Railroad Age Gazette* in its issue of August 21, page 775, F. O. Melcher, General Manager of the Chicago, Rock Island & Pacific, and representatives of the telegraphers on this road, have reached an agreement regarding the hours of work of telegraphers under the hours of labor law. By the

terms of the agreement the Rock Island will not require any of its operators to work "broken tricks." When operators do not work continuously during their shifts, the hours in the shift during which they are off duty will be continuous. In other words, if they begin a nine-hour day's work at 7 a.m. and quit at 7 p.m. they will have off during the day three consecutive hours. The Rock Island also agreed to increase the pay of the operators in its general offices at Chicago and Topeka \$2.50 per month. This advance in wages was made because it was shown that the Rock Island was paying its operators at these points less than was being received by the operators of other roads who were performing similar duties.

Passengers Must Buy Tickets on Burlington in Nebraska.

P. S. Eustis, Passenger Traffic Manager of the Chicago, Burlington & Quincy, has issued an order that on and after September 6, passengers who are not provided with tickets shall not be permitted to enter passenger trains leaving stations in Nebraska where ticket offices are maintained. Ticket agents are directed to give the widest possible publicity to the rule, and conductors are instructed to see that trainmen do not permit passengers to enter cars without first showing their tickets. The Burlington has had a similar rule in effect in Missouri since last March, and like action may be taken in other states.

The 2-cent fare law of Nebraska provides that railroads may collect a penalty of 25 cents from passengers who pay cash fares on trains, but a rebate check must be given for the amount. The result has been that an abnormal number of passengers have paid fares on trains, especially local trains. This has put a large amount of work on the conductors and has rendered it difficult for them to attend to their other duties.

Indiana Commission Orders Precautions to Prevent Accidents.

The Indiana Railroad Commission has issued a circular regarding accidents to trespassers in which it says:

"One hundred and seventy-three persons were killed while trespassing on the tracks or cars of the railroads in Indiana during the year ending June 30. While the railroads are not to be held responsible for these deaths as they are for accidents resulting from negligence, it is an act of humanity and a moral, if not a legal, obligation to prevent this loss of life where it is possible to do so. Nine states of the Union make explicit proscriptions with reference to walking on railroad tracks, and three, as all should do, expressly forbid it. The state of Indiana makes it unlawful only after warning.

"In a recent special case in one of the large cities of the state, where railroad tracks were notoriously and daily used by large numbers of citizens as thoroughfares, the commission called upon the division superintendents to take steps under this statute to abate this practice. We are now advised by the railroad company that warning signs are placed at the principal streets, that the mayor has promised he will have policemen placed to notify the people that they are trespassing, and that the road does not feel it necessary for a member of the commission to come to that city for the purpose of taking up this question with these people. The same work should be undertaken at many places in this state. A more systematic, general and determined effort should be made by the railroad companies and local authorities to keep trespassers off the tracks. We recommend and direct that you [the railroads] shall place warning signals, indicating 'danger,' in red letters at such places in towns, cities and country, and on such bridges and trestles as are often and repeatedly used by the public for footways. We recommend and direct that you shall seek the co-operation of local authorities, and that you advise the commission of the results of your efforts, to the end that we may use our official influence to aid you in any case

where local authorities refuse to enforce the law. You will take this most important matter up at once and advise us as indicated herein."

The Chicago, Indianapolis & Louisville having declined to put up at highway crossings danger signals recommended by the commission, the commission has written a letter to the general manager in which it asks whether "coercive" process will be necessary in order to secure obedience to its recommendation.

New Record by the Lusitania.

The Cunard turbine steamship "Lusitania" arrived at Sandy Hook Light, New York, at 9.30 p.m., August 20, in four days 15 hours from Daunt's Rock, Queenstown; or three hours 40 minutes better time than the best previous record. This trip was made over the short course, 2,781 miles long; average speed, 25.05 knots an hour. The best previous rate, which also was made by the "Lusitania," was 25.01 knots, last November. On last week's trip the "Lusitania" ran 650 knots in 24 hours, an average of 25.66, which beats the best previous 24-hour run by seven knots.

Society of Railway Financial Officers.

This society will hold its next annual meeting at the New Willard Hotel, Washington, D. C., October 14. The President of the society is F. H. Hamilton (St. L. & S. F.), St. Louis, Mo.

Municipal Traction Earned Surplus.

For the month of July the gross earnings of the Municipal Traction Co., Cleveland, Ohio, were \$437,174, total operating expenses \$282,663, leaving net earnings of \$154,511. Taxes, interests, rental and dividends were \$134,815, leaving a surplus of \$19,696. This is the first surplus the company has shown since it took over the lines. Mayor Johnson says that within a year a three-cent fare will yield a handsome surplus.

Columbia University Evening Courses.

Columbia University will offer at night during the year 1908-09 twenty evening courses in applied mechanics, applied physics, architecture, electricity, fine arts, industrial chemistry, mathematics, and surveying and structure.

Compensation for Injuries of Employees of the United States.

The Act of May 30, 1908, entitled "An Act granting to certain employees of the United States the right to receive from it compensation for injuries sustained in the course of their employment," went into effect on August 1. Under previous laws, compensation in case of injury is paid to employees in the Railway Mail Service and in the Life Saving Service. The new law applies to persons employed by the Government as artisans or laborers in the following services: Arsenals; navy yards; river and harbor construction; fortification construction; hazardous employment in the Reclamation Service, namely, in construction and in control and management of works; hazardous employment under the Isthmian Canal Commission; Government manufacturing establishments.

According to a rough estimate made by the Department of Commerce and Labor, about 75,000 Government employees come within the provisions of the law. Compensation will be paid under this act only for such injuries to an employee as occur in the course of his employment and cause inability to pursue his employment for more than fifteen days. Compensation is not paid if the injury is due to the negligence or misconduct of the employee injured. The compensation consists of a continuance during the period of disability, but not over one year, of the same pay which the employee was receiving at the time of the injury. If the employee is killed, the same amount is paid to dependent relatives for twelve months.

The administration of the act is intrusted to the Secretary

of Commerce and Labor, and all questions of negligence or misconduct are to be determined by him. The records of the application of this act will furnish useful material for statistics of accidents, which, for this country, are quite meager. In order to make the statistics more complete and valuable, reports of all accidental injuries to Government employees, regardless of the application of this act, have been requested from all Government establishments and offices. The number of United States Government employees exceeds 300,000.

Traffic News.

The State Railroad Commission of Louisiana has sent to the Interstate Commerce Commission a formal protest against the enforcement of a general advance in railroad freight rates.

The New York State Public Service Commission, Second district, will henceforth each week furnish to the press a statement of changes in freight, express or passenger rates, which have been filed with the commission during the week.

The Illinois Railroad Commission has given notice that on September 10 it will hold a hearing on petitions for additions and changes in Illinois Classification No. 10. The hearing will be at 218 La Salle street, Chicago. The docket contains 31 proposed changes.

An increase of 12 per cent. in the number of passengers carried and a decrease of 6 per cent. in passenger receipts are the net results to the Chicago & Alton of 12 months' operation under the Illinois two-cent passenger fare law, according to figures made public by the Traffic Manager.

The Bessemer & Lake Erie hauled 741,000 gross tons of ore from Conneaut Harbor to the mills of the Pittsburgh district in July. This was the second largest ore tonnage in the history of the road. August will show practically the same tonnage, and September is expected to break all records.

The express companies operating on railroad and steamship lines between Milwaukee and Chicago will make an advance of from 5 to 15 cents upon all shipments, effective September 1. The rate between Milwaukee and Chicago will be advanced from 60 to 75 cents and other advances will be in proportion.

The Federal Government appears as complainant in a case recently filed with the Interstate Commerce Commission against the Denver & Rio Grande. It asks to have demurrage charges aggregating \$400 declared illegal. The proceeding is brought by the Interior Department to recover alleged excess rates for detention of cars at Thistle Junction.

According to a newspaper statement the Interstate Commerce Commission has made a decision which requires the elaborate summer excursion books issued by the principal roads to be printed on sheets 10 x 12 in., because they are tariffs, showing fares; that being the size prescribed for all tariffs which are to be filed with the commission.

Pending a final decision by the United States Supreme Court in the lumber rate controversy the agents of the Union Pacific in Oregon have announced that from October 15 the rates fixed by the Interstate Commerce Commission will prevail. This amounts to a victory for the lumbermen, since the decision of the Commission virtually restored the tariffs that were in effect prior to November 1, 1907.

Representatives of the railroads and the cotton compress companies in Oklahoma having failed to agree upon changes in the rules regarding the compressing of cotton, the matter has been referred to the State Corporation Commission. The cotton compress interests have asked for an order requiring the concentration of cotton in transit at the first compress. They also ask a compressing in transit rate, like that granted to millers for milling in transit.

At Guthrie, Okla., August 15, the Missouri, Kansas & Texas was arraigned before the State Corporation Commission for contempt in having neglected to post bulletins at stations to give information as to delayed passenger trains; but as this was the first time the company had been brought up for this

crime, and as the order to comply with the law had been duly issued to the agent, the commission let the culprit off on payment of costs, including the witness fees and mileage of the man who had made the complaint.

The Georgia Railroad Company has applied to the Railroad Commission of that state for permission to increase its passenger fares from $2\frac{1}{4}$ cents a mile to $2\frac{1}{2}$ cents. With the application is a statement showing that in the ten months during which the reduced rate has been in effect the receipts fell off \$1,639 as compared with the same period a year before. In the territory occupied by this road, the Southern Railway, the Seaboard Air Line and the Central of Georgia are allowed to charge $2\frac{1}{2}$ cents.

The Illinois Railroad Commission has sent to commercial organizations and railroads in Illinois copies of a proposed rule regarding the marking of less than carload freight, which it considers adopting. Shippers will be given an opportunity to be heard before the rule is put into effect. The proposed rule conforms closely to that which appears in the principal freight classifications requiring each package, bundle, or piece of less than carload freight to be plainly marked with the full name or initials of consignee and the destination in full.

Sixty produce commission merchants of Pittsburgh have complained to the Interstate Commerce Commission of the demurrage charges imposed by the Pennsylvania at Pittsburgh. From April to December each year the charges to the defendants are increased above the regular demurrage charge by \$1 a car for the second 48 hours, \$3 a car for the third 48 hours and \$1 more thereafter. The complaint alleges that these additional charges are made only on interstate shipments, as, under the Pennsylvania law, they would be illegal. These produce merchants use cars as stores from which to distribute their merchandise.

Counsel for the government filed a petition in the United States Circuit Court of Appeals at Chicago on August 21 for a rehearing by the Court of Appeals of the appeal of the Standard Oil Company of Indiana in the case in which the Standard Oil Company was fined \$29,240,000 for the alleged acceptance of rebates from the Chicago & Alton. The petition of counsel for the government criticizes several features of the opinion rendered by Judge Grosscup in the Circuit Court of Appeals in reversing the judgment of the District Court. Among other things counsel for the government charged that the opinion of the Circuit Court of Appeals does injustice to Judge Landis, that if upheld it will impede the enforcement of the interstate commerce act, and that it misstates parts of the record.

Second class passenger rates from St. Paul and Missouri river points to Spokane, Wash., will be abolished by tariffs which go into effect September 1. Under the new tariffs the only rate applied in either direction will be the first class rate of \$38.70. The reason assigned for the abolition of the second class fares is that in consequence of the establishment of state laws fixing maximum passenger fares of 2 cents and $2\frac{1}{2}$ cents a mile in the Northwest the first class fare has been reduced from \$42.50 to \$38.70. The difference between this latter rate and \$35, which has been the second class rate, was deemed too small to warrant maintaining a second class rate. The first class rate from Spokane to Denver has been reduced from \$40 to \$38.55, and the second class rate has been made \$35 instead of \$30. From Pacific coast points from which the first class rate to St. Paul and Missouri river points is more than \$40, the second class rate will be \$40.

Chairman McCain, of the Trunk Line Association, has again notified the trans-Atlantic steamship lines that the railroads have decided not to reduce rates on export grain from Lake Erie to the Atlantic seaboard. He gives as the reasons: (1) that to meet the Montreal tariff it would be necessary to make unremunerative rates; (2) the members of the New York Produce Exchange who were consulted were unable to give any assurance that the proposed reduction would increase the movement from Lake Erie; (3) the proposed reduction would seriously disturb rates on other traffic, and (4) it is believed that the present increased movement of grain to Montreal is abnormal and temporary.

STATE COMMISSIONS.

New York. The New York Central & Hudson River Trolley Holding Company.

In re plan to distribute Mohawk Valley Co. holdings.

The first step is for the Mohawk Valley Co. to reduce its capital stock, such reduction to be accomplished by distributing railroad stocks owned by it to the amount of \$17,065,800, par value, pro rata among the stockholders. The New York Central & Hudson River being a stockholder to the amount of \$12,000,000 its stock would be reduced by the proposed operation, and it will receive in lieu thereof the stock of the various companies held by the Mohawk Valley Co. to the amount of \$10,230,480. This step the commission decides to be unobjectionable. It in effect transfers to the applicant the absolute ownership of property to which it is entitled through its ownership of stock in the Mohawk Valley Co.

The second step is that the New York Central & Hudson River shall purchase and acquire 29,987 shares of the common stock of the Rochester Railway. The Rochester Railway operates a street railway in the city of Rochester, and has a total capitalization of \$6,000,000, \$3,000,000 being common stock divided into 30,000 shares of the par value of \$100 each. All of this common stock, except 13 shares, is owned by the Rochester Railway & Light, a lighting corporation.

The par value of the 39,987 shares of the common stock of the Rochester Railway proposed to be acquired is \$2,998,700. It is proposed to pay for such stock the sum of \$4,500,000 or substantially \$150 per share. It is provided that the purchase price shall not be paid until the stock is free from the lien of this mortgage, but that such purchase price shall be placed in escrow ready to be delivered whenever the proper arrangements can be made freeing the stock from its present lien.

The third step in this series of operations is that the New York Central & Hudson River asks permission to purchase and own 82,741 $\frac{1}{2}$ shares of the stock of the Rochester & Eastern Rapid Railway of the par value of \$8,274,120.

The net result of the changes involved is that instead of owning the surrendered capital stock of the Mohawk Valley Co. the New York Central & Hudson River will be the owner of stocks to the amount of \$10,230,480, and that instead of holding the indebtedness against the Mohawk Valley Co. of \$4,500,000 it would be the owner of the capital stock of the Rochester Railway of the par value of \$2,998,700 and of the assumed value of \$4,500,000. This action is approved, the commission insisting that it must, however, be clearly understood that this action of the commission is not to be construed as an unqualified approval of the results to which it assents.

The application of the Rochester & Eastern Rapid Railway Co. is for the consent of this commission to increase its capital stock from the sum of \$1,500,000 to \$15,890,800, thus making an increase in the amount of its common capital stock in the sum of \$13,790,200.

There is nothing in the present condition of this company, if it be considered by itself, which demands for the purposes of its successful operation as a railroad that its capital stock be increased. For reasons it has been selected, however, as a company which shall become the owner and holders of certain other railroad stocks which must be placed somewhere under the proposed scheme relative to the holding of the Mohawk Valley Co. This application is granted.

The next step is to be as follows: The consolidated company succeeding to the Rochester & Eastern Rapid Railway would be the owner of the total capital stock of the Oneida Railway, and the Utica & Mohawk Valley, which it is proposed to acquire. Upon the acquisition of this stock by the consolidated company, it then being the owner of the total capital stock of the two companies, it is proposed to merge the same with the consolidation, pursuant to the provisions of the statute in that behalf and thus extinguish these two companies, and reduce the number of companies to three, namely, Schenectady, Syracuse Rapid Transit and the Consolidated.

This completes the series of operations definitely projected, although it is clearly understood that these applications are granted upon the express understanding that it is contem-

plated by the applicants to consolidate and merge the companies, and to place a general refunding mortgage upon the property of the consolidated company, and that these applications are granted for the express purpose of bringing about the final results as indicated. The commission grants these applications in view of all the reasons presented to it in connection with the entire series of transactions. It might hesitate seriously to grant these applications were the proceedings to stop with them and nothing further be done. It realizes that it has no powers to compel the consolidation or the merger, and that these acts will take place depends upon the good faith of the parties which is pledged to the same, and of which pledge these remarks are to remain as the evidence. Upon the theory that this is the proper way in which to handle the financial operations of all of the consolidated companies, it is believed that a better market can be found for bonds which are secured by all of the properties than for bonds which have a security upon the property of one company alone.

Traffic Agreement of the London & North-Western and the Midland.

The London & North-Western and the Midland Railway, of England, have made a traffic agreement whose "principles are, first, the elimination of all inducements to excessive competition * * * and, second, co-operation in the working of all competitive traffic. * * * The mode of application [of this agreement] is the division of receipts from competitive traffic in certain proportions, based upon the actual carryings of the two companies over a given period in the past." The agreement is for 99 years. Passengers holding tickets over the Midland, for instance, between London and Manchester, will have the option of traveling by the London & North-Western route in one or both directions and vice versa. Terminal facilities of both for handling freight and passengers may hereafter be used by either. It is said that the agreement will not require the sanction of Parliament.

Southern Railroads Reply to Complaint.

The railroads of the South have filed with the Interstate Commerce Commission their reply to the complaints which have been made concerning increases in freight rates. They ask the commission to dismiss the complaint about violation of the anti-trust law, because the commission has heretofore ruled that it has no jurisdiction to administer that law. Also the commission has ruled that even though a rate be the result of an illegal combination, it may be unreasonably low. It is declared that the Southeastern Freight Association does not suppress trade but promotes it. Associations are essential to the orderly conduct of commerce. For five days this month when, by reason of an order issued by the Federal court, rates were lower to Georgia than to points in other states, merchants in Louisville, Cincinnati and elsewhere made no sales, owing to the demoralization caused by the court's order; this demonstrates the usefulness and necessity of traffic associations. Rates to Atlanta were reduced by the roads in 1905 to put them into better relation to the rates to Birmingham and Montgomery, but those reductions were not reasonable or compensatory; they were made solely to satisfy the complainants. The recent increase in rates has not suppressed competition and the same competition exists as before. The commodities on which rates have been increased are not entitled to lower rates than other articles; the advance was small and right; it will not disturb existing trade relations. It is denied that the margin of profit obtained by the dealer prevents him from absorbing the advance in the rates; and even if he compels the consumer to pay a part or the whole of the increase, the consumer will not feel it nor will he be injured by it. The advance will not tax the people of Georgia \$500,000 yearly, or anything like that sum. The increase will not restrict the volume of traffic, and the rates are not sufficiently compensatory, even after the increase. Since February 1, 1905, gross and net earnings have largely diminished. The roads declare that the wages of their employees have been increased and that prices of all articles for the maintenance and equipment of their lines are higher; that the demand of the pub-

lic for efficiency of service has become more and more exacting as well as the demand for quicker transit, better terminal facilities, depots and stations, larger and more expensive cars, heavier engines, stronger bridges, heavier rails, and in all other respects that they have been compelled to meet an increased and most costly demand for safe, prompt and efficient service. The development of the South depends upon an increase rather than a decrease of their efficiency, and they believe that the public prefer to see such a reasonable and fair advance in rates as will insure a prompt, safe, efficient service, and consequent commercial development, rather than the holding down of the transportation companies to such scant return as will require them to reduce the wages of their employees and prevent them from maintaining service.

New York Rule for Marking L. C. L. Freight.

The New York Up-state Public Service Commission has issued its final order in the matter of marking less than carload shipments of freight. It provides that when articles are not boxed, barreled, crated or sacked, but are shipped loose, one out of every 10 pieces must be marked. If the shipment consists of less than 10 pieces at least two pieces must be marked. This rule is applied to flour, feed, cement, lime or plaster in sacks. Not more than 10 such markings shall be required for any one shipment, and each marking must show the total number of pieces.

Grapes, when shipped in lots of 10,000 lbs. or more by one consignor to one consignee, will be accepted without marking of packages.

Articles which are shipped loose from one consignor to one consignee and are loaded in cars to 30,000 lbs., or the cubic capacity of a car, will be accepted without marking.

National Industrial Traffic League.

A meeting of the National Industrial Traffic League has been called by President J. C. Lincoln to be held at the Planters' Hotel, St. Louis, Mo., on September 14. A large number of subjects are docketed for consideration, including the uniform bills of lading recommended by the Interstate Commerce Commission and the American Bankers' Association, uniform classification, general advance of freight rates and responsibility of carriers for rate quotations.

Western Classification Committee.

The Western Classification Committee at its recent meeting at Manitou, Colo., decided upon a number of important changes in the Western Classification. Some of these will become effective on November 1 and some on January 1.

New Rule 4, relating to the liability of the carrier for loss or damage, takes effect November 1. The provision that if the shipper desires to ship at carrier's risk he must pay a rate 20 per cent. higher than the regular rate, is stricken out.

The rule fixing a minimum weight of 20,000 lbs. on carload shipments in Classes 1, 2 and 3, and 30,000 lbs. in the rest of the classes is abolished, and the minimum weight for the particular commodity will be entered opposite every carload item. Generally speaking, the minimum weights for articles in Classes 1, 2 and 3 will be 24,000 lbs. and for the other classes 36,000 lbs. Rules were adopted to compel the more secure packing of vehicles, furniture, egg cases and other frail articles. Most of these rules were framed after conference and agreement with shippers. A rule regarding the marking of packages, which states more specifically the requirements for plain and indelible marking of freight than that now in effect was also adopted. The new rule is similar to that put into effect in Official Classification territory on July 1.

A new rule was adopted, effective January 1, 1909, providing that where boots and shoes are shipped in wooden cases, the cases must be nailed throughout with cement coated nails, not less than six penny fine, and the fact that they are so nailed must be stated on the shipping ticket or bill of lading. When this rule is not complied with one class higher will govern. The object of this rule is to reduce claims for loss due to the pilfering of boots and shoes.

REPORT OF EARNINGS AND EXPENSES OF RAILROADS.

MONTH OF JUNE, 1908.
(See also issues of August 7, 14 and 21.)

Name of road.	Mileage operated at end of period.	Operating revenues			Operating expenses			Total Net operating expenses (or deficit).	Taxes.	Operating (or loss).
		All other revenues from trans- portation.	Freight.	Passenger.	Total revenue from trans- portation.	Maintenance of way and structures.	Trans- portation.			
Atlanta & Birmingham Air Line	237	\$21,439	\$44,601	\$21,439	\$87,479	\$13,708	\$811	\$87,479	\$5,850	\$14,457
Atlantic City	168	77,274	52,997	77,274	150,271	12,892	1,870	150,271	7,000	24,726
Central of Georgia	1,913	229,379	507,133	229,379	756,931	121,676	30,982	756,931	38,597	1,224,726
Central R.R. Co. of New Jersey	468	1,302,339	843,413	1,302,339	2,604,752	233,783	30,838	2,604,752	187,531	524,982
Central Vermont	1,831	167,578	167,578	167,578	335,156	28,395	6,018	335,156	142,015	124,466
Chesapeake & Ohio	1,837	1,166,771	368,263	84,413	1,619,447	389,913	40,426	1,619,447	56,714	520,473
Chicago & Eastern Illinois	2,977	384,336	130,718	38,104	553,158	85,196	13,046	553,158	433,546	385,546
Chicago & Erie	2,977	200,949	99,474	30,120	330,543	62,306	43,337	330,543	1,869	336,288
Chicago, Cincinnati & Louisville	2,852	30,289	24,414	1,811	32,514	52,997	7,780	32,514	113,895	32,989
Chicago, Indianapolis & Louisville	2,917	211,145	128,892	36,940	376,977	428,368	12,651	376,977	17,278	106,577
Chicago, Peoria & St. Louis	2,235	174,735	141,376	14,998	331,109	85,178	5,997	331,109	585,195	1,008,231
Cincinnati, Hamilton & Dayton	1,038	446,638	707,306	243,166	1,400,110	85,178	23,851	1,400,110	1,122	559,537
Erie	1,899	115,725	61,307	1,137	178,169	121,189	10,536	178,169	33,695	81,893
Georgia	307	51,952	51,952	51,952	103,904	28,974	2,715	103,904	2,000	31,893
Gila Valley, Globe & Northern	344	51,141	51,141	51,141	102,282	10,114	3,446	102,282	2,831	58,543
Louisiana Ry. & Navigation Co.	4,365	84,916	84,916	84,916	169,832	134,038	8,846	169,832	63,469	900,208
Louisiana Western	351	178,346	80,178	17,769	276,293	32,651	90,962	276,293	1,038,096	77,828
Morgan's L. & Tex. R.R. & S. Co.	330	52,286	47,769	1,516	101,571	12,892	1,870	101,571	13,200	76,310
Nevada & California	132	103,460	48,562	23,783	175,805	17,977	1,854	175,805	16,316	3,116
New York, Susquehanna & Western	368	83,894	104,549	43,487	231,930	17,977	1,854	231,930	18,819	14,561
Northwestern Pacific	1,264	822,805	339,814	33,987	1,200,606	124,480	3,186	1,200,606	70,893	61,251
Oregon R.R. & Navigation Co.	1,451	971,730	481,185	20,123	1,473,038	287,471	80,726	1,473,038	585,927	529,716
Oregon Short Line	999	82,272	25,608	6,149	114,029	13,480	22,084	114,029	726,463	618,389
Philadelphia & Reading	4,727	1,472,366	613,631	21,477	2,107,474	301,992	5,429	2,107,474	3,373	1,008,231
St. Joseph & Grand Island	2,611	809,108	63,687	21,835	900,630	13,046	56,955	900,630	885,508	793,900
St. Louis & San Francisco	2,917	211,145	128,892	36,940	376,977	428,368	12,651	376,977	52,416	202,880
Seaboard Air Line	5,584	3,764,263	2,225,141	362,780	6,352,184	6,464,063	463,198	6,352,184	3,132	2,009,106
Southern Indiana	351	63,687	13,884	47,916	125,487	45,310	1,920	125,487	2,000	53,931
Southern Pacific—Pacific System	422	45,378	45,378	45,378	90,756	16,452	4,025	90,756	1,343,388	1,000,000
Southern Pac.—Atlantic S. S. Lines**	3,301	2,334,364	742,945	279,178	3,356,487	3,988,952	421,182	3,356,487	107,663	1,735,570
Trinity & Brazos Valley	442	398,475	398,475	398,475	796,950	71,949	4,921	796,950	20,504	118,215
Union Pacific	3,301	2,334,364	742,945	279,178	3,356,487	3,988,952	421,182	3,356,487	107,663	1,735,570
Wheeling & Lake Erie	442	398,475	398,475	398,475	796,950	71,949	4,921	796,950	20,504	118,215

TWELVE MONTHS OF FISCAL YEAR, 1908.

Name of road.	Mileage operated at end of period.	Operating revenues			Operating expenses			Total Net operating expenses (or deficit).	Taxes.	Operating (or loss).
		All other revenues from trans- portation.	Freight.	Passenger.	Total revenue from trans- portation.	Maintenance of way and structures.	Trans- portation.			
Atlanta & Birmingham Air Line	237	\$21,439	\$44,601	\$21,439	\$87,479	\$13,708	\$811	\$87,479	\$5,850	\$14,457
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Wheeling & Lake Erie	442	398,475	398,475	398,475	796,950	71,949	4,921	796,950	20,504	118,215

* Credit. † Deficit. ‡ Loss.

**Itemized operating expenses not given.

Freight Car Balance and Performance.

Arthur Hale, Chairman of the Committee on Car Efficiency, presenting statistical bulletin No. 30 of the American Railway Association, covering car balance and performance for April, 1908, says:

"As the first monthly compilation of these statistics was for April, 1907, this bulletin is the first which affords an opportunity for a comparison of the monthly performance on roads in the association, as well as for the various groups and the country at large. Owing to the unusual conditions which prevailed during the period covered by this report, satisfactory comparisons are limited to those items which are not directly affected by a condition of car surplus. Under this head we have the car balance figures, the per cent. of cars in shops, per cent. of loaded mileage and average tons per car. As pointed out in previous bulletins, such figures as the average miles per car per day and average earnings per car are based on the total cars on line, and to secure a satisfactory measure of efficiency for those cars which were actually engaged in service, allowance must be made for those cars which were idle. The adjusted average for April, 1908, is 25.0 miles per car per day, .2 higher than the average of all cars in April, 1907.

"The car balance figures furnish a striking example of how the car situation is affected by a reduction in the demand for cars. In April, 1907, with a shortage of approximately 100,000 cars, we find but 1,014,539 cars on the tracks of their owners, this number comprising 54 per cent. of the total number owned by reporting roads. In April, 1908, with a surplus of 365,627 there were 1,620,203 cars at home, or 78 per cent. of the total ownership. In April, 1907, there were six groups reported as holding cars in excess of their ownership, the total excess (by groups), being 96,975. In April, 1908, there are three groups showing an excess, one of which (group 3, Middle), had in reality less than 100 per cent., the apparent excess being due to the storage of Pennsylvania pool cars on the pool lines in this group. This leaves but two groups holding an excess, the total of such excess being 13,764 cars.

"Of the six groups which had less than their quota in 1907, there were two with but 86 per cent. and 84 per cent. respectively, while the average percentage of cars on these groups was but 91 per cent. of the total number owned. In April, 1908, there were no groups with less than 90 per cent., and only two with less than 95 per cent. Taken as a whole those groups with less than their quota had cars equivalent to 97 per cent. of their total ownership.

"A further result of the decreased traffic was an increase in the number of bad order cars from 5.14 per cent. in April, 1907, to 9.93 per cent. in April, 1908. The total of such cars was 214,537, an increase of 103,487 over April, 1907. With greatly reduced revenues, a car surplus equal to 17 per cent. of the total equipment and without prospects of any immediate improvement, it was scarcely to be expected that railroads would keep the proportion of bad order cars down to the low figure which was maintained while there was an active demand for equipment. Loaded car mileage, which was 70.6 per cent. in April, 1907, was only 66.5 per cent. in April, 1908. A comparison of the load per car during the two periods would be valuable, but unfortunately the ton mileage figures for months prior to January, 1908, do not include company freight, and are therefore not comparable with figures for 1908, which include this item.

"Compared with March, 1908, the April performance was unsatisfactory, the car mileage, tonnage and earnings falling off. The actual miles per car per day averaged 19.6, the lowest of which we have any record. The elimination of the surplus available and excess bad order cars, however, gives an average of 25.0 miles per day, which, while slightly lower than the adjusted average for March, compares favorably with actual averages during periods when cars were in demand. Applying the same adjustment to the earnings, we secure an average of \$2.38 per day for each car actually in use. Although there was an increase in the number of cars on home lines, indicating a resumption of the return of foreign cars, temporarily checked in March, this change in balance was not accompanied by an increase in the percentage of empty

FREIGHT CAR EFFICIENCY FOR APRIL, 1908.

	New England	New York, New Jersey, Del., Md., Eastern Pa.	Ohio, Indiana, Mich., Western Pa.	Virginia, W. Va., No. and So. Carolina	Ky., Tenn., Miss., Ala., Ga., Fla.	Iowa, Ill., Wis., Minn.	Montana, Wyo., Neb., Dakotas	Kansas, Colo., Okla., Ind. T., Mo., Ark.	Texas, Louisiana, N. Mex.	Oregon, Idaho, Nev., Cal., Arizona	Canadian Lines	Grand total.
Railroad-owned cars:												
Revenue freight cars owned.....	69,729	671,636	280,144	135,469	167,119	371,024	15,864	139,022	26,735	113,747	96,501	2,087,020
Average number system cars on line.....	55,087	530,059	233,795	99,254	127,248	296,374	6,345	107,816	18,827	68,475	76,923	1,620,203
Average foreign cars on line.....	21,665	138,167	61,401	26,796	31,062	62,814	8,800	19,772	14,649	40,259	15,636	441,021
Total cars on line.....	76,752	668,226	295,196	126,050	158,310	359,188	15,145	127,588	33,476	108,734	92,559	2,061,224
Excess.....	7,023	.....	15,052	.....	.....	.....	.....	.....	6,741	.....	.....	.....
Per cent. cars on line of total owned:												
Home.....	79	79	83	73	76	80	40	78	70	60	80	78
Foreign.....	31	20	22	20	19	17	55	14	55	35	16	21
All railroads.....	110	99	105	93	95	97	95	92	125	95	96	99
Private cars on line.....	2,798	38,519	13,344	3,438	6,310	10,892	1,367	5,604	2,777	10,465	3,751	99,265
Total, all cars on line.....	79,550	706,745	308,540	129,488	164,620	370,080	16,512	133,192	36,253	119,199	96,310	2,160,489
Per cent. of cars in shop.....	7.32	12.79	8.62	8.37	7.14	6.51	8.62	14.90	5.71	8.51	6.36	9.93
Number of freight engines owned.....	1,144	9,867	3,777	2,240	2,497	6,343	445	2,401	673	2,345	2,076	33,808
Av. cars on line per freight engine owned.....	70	68	78	58	66	58	37	55	40	49	46	64
Total freight car mileage.....	38,930,863	408,558,286	139,335,025	71,295,098	96,298,111	215,834,312	19,872,774	74,253,221	25,757,264	93,102,241	69,431,487	1,247,668,682
Average miles per car per day.....	16.3	19.0	15.1	18.4	19.5	21.5	40.1	18.6	23.7	26.1	24.2	19.6
Per cent. loaded mileage.....	68.3	64.6	63.4	65.3	66.1	72.8	73.7	65.7	61.2	69.8	71.7	66.5
Ton-miles of freight, inc. Co. freight.....	415,225,949	5,795,037,306	1,740,180,946	854,171,598	1,185,904,737	1,745,546,373	280,127,952	855,382,193	139,431,015	1,319,102,898	916,828,306	15,246,939,273
Average ton-miles, including Co. freight:												
Per car-mile.....	10.7	14.4	13.1	12.0	12.5	12.6	14.6	11.5	10.1	14.2	13.1	13.3
Per loaded car-mile.....	15.7	22.2	20.7	18.3	17.5	18.0	20.0	17.7	16.1	20.4	18.3	20.0
Per car per day.....	174	273	207	220	242	252	603	215	262	370	317	258
Gross freight earnings.....	\$6,595,492	\$37,168,270	\$10,089,239	\$6,791,352	\$8,327,035	\$15,875,116	\$2,413,809	\$7,516,385	\$2,253,863	\$12,347,335	\$5,895,109	\$115,873,005
Average daily earnings: Per car owned.....	\$3.15	\$1.84	\$1.27	\$1.68	\$1.69	\$1.85	\$5.07	\$1.81	\$2.83	\$3.63	\$2.04	\$1.93
Per railroad car on line.....	2.86	1.85	1.21	1.77	1.77	1.92	4.87	1.92	2.25	3.80	2.12	1.96
All cars on line.....	2.76	1.77	1.15	1.75	1.70	1.85	4.87	1.89	2.08	3.47	2.04	1.86

mileage, the proportion being unchanged from February and March figures.

"The tons per loaded car, which had steadily fallen off since January, shows a further decrease, the loading for April averaging 20.0 tons per car. With the marked decrease in coal and ore traffic, which commodities normally hold up the average load per car, it is surprising that this reduction was so slight, especially as the natural tendency during business depression is toward a lighter load in general traffic.

American Association of Traveling Passenger Agents.

The annual convention of the American Association of Traveling Passenger Agents will be held at Seattle, Wash., on September 14 and 15. The Butler Hotel Annex will be the official headquarters. At the first day's session the following question will be discussed: "In View of the Changed Conditions in Recent Years Relating to Passenger Traffic and the National and State Legislation Enacted Affecting Such Traffic, What Are the Best Methods for Traveling Passenger Agents to Adopt?" During the convention the Alaska-Yukon-Pacific exposition grounds will be visited. There will be a banquet, a ball, an excursion to the navy yard on Puget sound and a tour around the north end of Puget sound, the visitors being guests on this trip of the Pacific Coast Steamship Co.

Equipment and Supplies.

LOCOMOTIVE BUILDING.

The Ann Arbor is in the market for from six to ten locomotives.

Eastman-Gardner & Co. have ordered one locomotive from the Baldwin Locomotive Works.

The Western of Havana has ordered one locomotive from the Baldwin Locomotive Works.

The Shreveport, Houston & Gulf has ordered one locomotive from the Baldwin Locomotive Works.

The Menominee Bay Shore Lumber Co., Menominee, Mich., is having one locomotive built at the Pittsburgh works of the American Locomotive Co.

CAR BUILDING.

The Chicago & North-Western is asking prices on 64 passenger cars.

The Carolina, Clinchfield & Ohio is in the market for 10 passenger coaches.

The Atlanta, Birmingham & Atlantic is asking prices on a number of passenger cars.

The Chicago & Alton has ordered 1,000 steel 50-ton coal cars from the Standard Steel Car Co.

The Texas City Refining Co., Texas City, Tex., has ordered 55 steel underframe 10,000-gal. tank cars from the American Car & Foundry Co.

The Delaware, Lackawanna & Western, as reported in the *Railroad Age Gazette* of August 14, has ordered 300 steel hopper cars of 80,000 lbs. capacity from the American Car & Foundry Co. These cars will be 30 ft. $\frac{1}{4}$ in. long and 9 ft. 5 $\frac{1}{2}$ in. high, inside measurements, and 34 ft. long and 10 ft. wide, over all. Bodies and underframes will be of steel. The special equipment includes:

Brakes	Westinghouse
Brake-beams	Pennsylvania
Brake-shoes	Lappin, steel-backed
Brasses	Magnus Metal Co.
Couplers	Gould
Doors	Dunham hopper
Draft gears	Miner tandem
Dust guards	Wooden
Journal boxes	McCord
Paint	Wadsworth, Howland & Co.
Side bearings	Malleable
Springs	Railway Steel Spring
Trucks	Arch bar, with Barber rollers
Wheels	Cast iron

The City of Edmonton, Alberta, Can., has ordered seven electric cars from the Ottawa Car Co.

The St. Louis & San Francisco is said to be in the market for 100 freight cars. This item is not yet confirmed.

The Atlantic Coast Line has ordered 500 steel underframe box cars from the South Baltimore Steel Car & Foundry Co.

IRON AND STEEL.

The Carolina, Clinchfield & Ohio is in the market for 6,000 tons of bridge steel.

The Grand Trunk is in the market for 1,000 tons of steel for bridge construction.

The Louisville & Nashville has ordered 200 tons of fabricated steel from the Louisville Bridge Co.

The Pittsburgh, Cincinnati, Chicago & St. Louis has given the contract to the Pennsylvania Steel Co. for 2,000 tons of finished steel for rebuilding a portion of its bridge at Steubenville, Ohio.

The Norfolk & Southern is preparing plans for a considerable amount of steel and wooden trestle work for Albemarle Sound, including a draw span and two plate girder spans, requiring about 1,800 tons of steel.

RAILROAD STRUCTURES.

CANADIAN, TEX.—An officer of the Atchison, Topeka & Santa Fe writes that the contracts recently let to C. A. Fellows are for a 10-stall roundhouse to cost \$30,000, also a sandhouse of wood, 24 ft. x 60 ft., to cost \$3,000. Work is now under way.

CHANUTE, KAN.—The Atchison, Topeka & Santa Fe will soon resume work on its car repair shop. Part of these improvements were completed last fall.

CLEVELAND, OHIO.—An officer of the Wheeling & Lake Erie writes that no authority has been given to build a passenger station, other than a temporary one, to cost \$5,000. Later the matter of putting up a permanent station will be taken under consideration. (Aug. 14, p. 733.)

Negotiations are still pending between the city officials and the Detroit & Cleveland and the Cleveland & Buffalo Steamship companies for the leasing of land at the foot of Erie street as a site for a joint warehouse. An officer writes that from present indications the lease will not be agreed upon for some time. (Aug. 21, p. 781.)

DALLAS, TEX.—The Missouri, Kansas & Texas is enlarging its terminal facilities, including the addition of several new tracks. The cost of improvements will be about \$250,000, including the erection of a roundhouse.

FOREST CITY, ARK.—An officer of the Chicago, Rock Island & Pacific writes that a contract has been given to the Geo. B. Swift Co., Chicago, to put up a frame passenger station. Work is to be begun at once. (July 24, p. 596.)

FORT WORTH, TEX.—An officer of the Missouri, Kansas & Texas writes that no shops are to be put up at present at that place. Work on the division freight yard has been resumed, also on a local freight yard. A new fireproof freight house has recently been finished but is not yet occupied.

MCALISTER, OKLA.—The Missouri, Kansas & Texas is preparing to remove the headquarters of the Choctaw division from Muskogee, Okla., to McAlester, and work is now under way on 16,000 ft. of new track. The plans also include the building of a new roundhouse.

NORTH YAKIMA, WASH.—The Northern Pacific is completing plans for a new passenger station to cost about \$75,000. Construction will not be begun until next spring.

NORWALK, OHIO.—The general repair shops of the Wheeling & Lake Erie were destroyed by fire on August 23. The loss is said to be \$300,000. The question of rebuilding the shops, it is said, led B. A. Worthington, Receiver, to propose that if the city would grant inducements in the way of additional land, he might recommend building in Norwalk the general shops planned for Brewster, Ohio, to cost about \$1,800,000.

PEORIA, ILL.—The Chicago, Rock Island & Pacific has awarded the contract for erecting a freight house to J. J. Jobst, of Peoria. (Aug. 14, p. 734.)

PORTLAND, ORE.—Plans have been drawn by the Oregon Railroad & Navigation Co. and the Southern Pacific for a new dock to be about 1,500 ft. long. The enlarged wharf will extend from Albers dock on the north to the plant of the Portland Gas Company on the south.

The Portland Railway Light & Power Co. is preparing plans for a new car barn having a capacity of 250 cars.

SALIDA, COLO.—Plans have been prepared by the Denver & Rio Grande for new repair shops. The proposed building will be of brick, 325 ft. x 130 ft. It will be equipped with two electric cranes. Work will probably not begin until next spring.

TAMPA, FLA.—The Seaboard Air Line has awarded a contract for erecting three wharves and a warehouse to Burwell & Hillyer, Jacksonville, Fla. The wharves will have a total frontage of 2,400 ft.; one for lumber or naval stores, 59 ft. x 1,200 ft.; a general merchandise dock, 50 ft. x 500 ft., with storage warehouse, 75 ft. x 400 ft., and a phosphate dock, 50 ft. x 700 ft., which will be equipped with hoisting machinery. The Phoenix Bridge Co., Phoenixville, Pa., was awarded the contract for a steel lift bridge, for which V. M. Johns, Portsmouth, Va., will build the approaches. A phosphate elevator will be built by the C. W. Hunt Co., 45 Broadway, New York. (Aug. 21, p. 782.)

TEMPLE, TEX.—A local press report says that plans have been drawn by the Atchison, Topeka & Santa Fe for a new passenger station, also that the arrangement of freight and passenger yards and improvement of freight facilities is intended. It is said that these improvements will incur an expenditure of \$150,000.

WAXAHACHIE, TEX.—A brick passenger station, 25 ft. x 117 ft., is being built by the Missouri, Kansas & Texas, to cost \$10,000.

WESTFIELD, N. Y.—The Buffalo & Lake Erie Traction Co., Buffalo, N. Y., will build a double-track steel viaduct 1,400 ft. long, with concrete piers and approaches, near here. Bids were recently received for an all-concrete structure but were rejected. The Western New York Construction Co., 535 Brisbane building, Buffalo, N. Y., is receiving the bids.

SUPPLY TRADE NOTES.

The Kinnear Manufacturing Co., Columbus, Ohio, has removed its Chicago office from 112 Clark street, to room 1212, Corn Exchange Bank building.

The Heine Safety Boiler Co., St. Louis, Mo., has given a contract to the Ritter-Conley Co. for the 1,000 tons of structural steel to be used in erecting its new boiler shop.

The Farlow Draft Gear Co., Baltimore, Md., has been notified that its twin spring gear has been specified on 450 cars now building for the Iowa Central at the works of the Mt. Vernon Car Mfg. Co.

The Ritter Folding Door Co., Cincinnati, Ohio, has been awarded the contract for furnishing doors for the depot and express building of the Delaware, Lackawanna & Western at Scranton, Pa.; F. D. Hyde, contractor.

The International Lock Nut & Bolt Co., Paterson, N. J., has been incorporated with a capital stock of \$1,000,000 to manufacture lock nuts and bolts. The incorporators include Max Rosenstein, Sigmund Rosenstein and Harry S. Munzer, all of Paterson, N. J.

H. L. Mills, formerly in the sales department of the Whiting Foundry Equipment Co., has resigned to accept the presidency of the American Specialty Co., 1440 Monadnock building, Chicago. This company is placing the "Use-Em-Up" drill socket on the market.

The Wisconsin Engine Co., Corliss, Wis., has just announced that, in addition to the high-duty Corliss and pumping engines, it is manufacturing gas engines for all purposes and will be pleased to receive inquiries from and to correspond

with interested parties concerning installations which include gas engines in units up to 5,000 h.p.

The American Automatic Fender Co., Minneapolis, Minn., is being organized with a capital of \$500,000 to engage in the manufacture of street car fenders and locomotive pilots. F. A. Nelson, of Minneapolis, is the patentee of the devices.

The Baker-Stewart Door Equipment Co., Indianapolis, Ind., recently sold to the Pennsylvania Railroad the right to manufacture and use its new patent standard car door. This patent car door was described in detail in the *Railroad Gazette* of February 1, 1907, page 156.

The Joliet Steel Car Manufacturing Co., Joliet, Ill., has been incorporated under the state laws of Delaware with an authorized capital stock of \$2,000,000 to manufacture non-telescoping and steel railroad cars of every description. The incorporators are: John R. Meacham, Bryan Hutchinson and C. B. Antram, of Joliet, and Harry W. Davis, of Wilmington, Del.

The Price Boltless Rail Joint Co. has filed articles of incorporation in Louisiana for the purpose of manufacturing and selling the Price boltless rail joint, the invention of John Price, of Crowley, La. The company is capitalized at \$100,000. The board of directors include: Edward Wunderlich, E. H. McFall, P. D. Parks, F. A. Lambert, John Price, E. B. Stafford, A. H. Dicks, Edwin L. Lang and S. W. Stafford.

The Western Steel Car & Foundry Co., Chicago, has awarded the contract for concrete foundations and sheet metal work to William P. McEvoy, 97 Clark street, Chicago, for a steel car shop and car erecting shop to be built as additions to the company's plant at Hegeswich, Ill. They will be one-story structures, 200 ft. x 240 ft., and 150 ft. x 300 ft., respectively, and cost \$150,000 each. The same contractor will build a paint shop, 140 ft. x 500 ft., in connection with the improvements planned for the Hegeswich plant. The paint shop will be one story, of concrete or steel construction, and cost \$100,000.

Max J. L. Tower, 444 Vinewood avenue, Detroit, Mich., has purchased 7½ acres of land at the intersection of the Michigan Central and South Dearborn road, Detroit, upon which he proposes to erect a bridge and structural steel plant. Plans are now being prepared and as soon as they are completed a stock company with a capital of \$300,000 will be organized to go ahead with the construction. Mr. Tower was formerly with the Detroit Bridge & Iron Works and its successor, the American Bridge Co., as plant manager for 28 years. He will personally superintend the erection of the new plant and will also be a large stockholder in the company.

J. Frank Case, formerly Assistant Secretary of the Norfolk & Southern, has taken a position in the railroad sales department of the National Paint Works, Williamsport, Pa. He will make his headquarters at the main sales office, 100 William street, New York, and will attend especially to the New York City and New England railroad trade. In addition to his work as Assistant Secretary of the Norfolk & Southern, Mr. Case was private secretary to the President, Frank S. Gannon, where his duties were of a general nature in connection with all departments. Prior to his connection with the Norfolk & Southern, he was in the service of various other railroads. The National Paint Works has as its southern representative W. B. Kilpatrick, who makes his headquarters at Washington, D. C., and is also an old railroad man, having been on the Baltimore & Ohio Southwestern for a number of years and recently was private secretary to Assistant Secretary Newberry, of the Navy.

TRADE PUBLICATIONS.

Potential Starter.—The Allis-Chalmers Co., Milwaukee, Wis., has issued four leaflets supplementing instruction book 5,007, giving a list of the supply parts for potential starters, types A1, A2, B1 and C1.

Locomotive Sander.—A leaflet just issued by the United States Metal & Mfg. Co., New York, describes the Ureco pneumatic track sander. A general plan shows the application of this sander to the locomotive.

Arc Lamps.—The Western Electric Co., Chicago, is dis-

tributing an attractive mailing card showing various types of Western Electric arc lamps and advancing reasons why they are efficient in operation.

Cable Joints.—Dossert & Co., Inc., New York, have issued their fourth annual catalogue of Dossert solderless connectors, cable taps and terminals. These connectors provide for making splices, tap-offs and terminal connections on both stranded and solid conductors without using solder.

Air Compressors.—Catalogue No. 26, issued by the Chicago Pneumatic Tool Co., Chicago, describes in detail the Franklin air compressors which it manufactures. The catalogue is well illustrated and contains several views showing the exterior and interior of its air compressor works at Franklin, Pa.

Brill's Magazine.—The August 15 issue of this magazine, published by the J. G. Brill Co., Philadelphia, Pa., contains several very interesting and instructive articles on recent street and interurban car construction, including an article on Semi-Steel Trail Cars for the Illinois Traction System.

Seamless Steel Barrels.—The Pressed Steel Tank Co., Milwaukee, Wis., is distributing a catalogue describing the patented seamless steel barrels which it manufactures. The barrels are made with bilged bodies and integral heads by a series of operations with patented dies on specially designed hydraulic presses.

Steel Mine Timbers.—A 30-page catalogue just issued by the Carnegie Steel Co., Pittsburgh, Pa., compares the use of steel timbers in coal mining operations with that of wooden timbers or concrete. The catalogue contains a large number of full-page illustrations of steel timber installations, also a number of detailed drawings.

Reinforced Concrete Construction.—The August issue of Designing Methods for Reinforced Concrete Construction, published by the Expanded Metal & Corrugated Bar Co., St. Louis, Mo., shows standard designs for bridges and culverts for highway traffic of the flat slab and girder type. The designs given in this bulletin are based on the methods outlined in its July number. The October number will treat of retaining walls of the cantilever and buttress types.

Boring Mills.—The results of 50 years' experience in building boring mills is effectively shown in a 9 in. x 12 in., 48-page catalogue just issued by the Niles-Bement-Pond Co., New York. The catalogue contains 31 three-quarter page half-tone illustrations. The following mills are illustrated and described: 30-in. turret boring and turning mill; 42-in., 51-in. and 60-in. mills; 6-ft. to 20-ft. mills; extension mills; tire mills and various attachments for these machine tools.

Cement.—The August bulletin of the Universal Portland Cement Co., Chicago and Pittsburgh, Pa., shows a number of structures built of Universal Portland cement, including the plant of Dolese & Shepard Co., at Gary, Ind.; the concrete work at the plant of the Inland Steel Co., Indiana Harbor, Ind., and a two-page view of Plant No. 5 of the Universal Portland Cement Co. The company has published a book on "Portland Cement Sidewalk Construction" by C. W. Boynton, which it will send free to anyone interested.

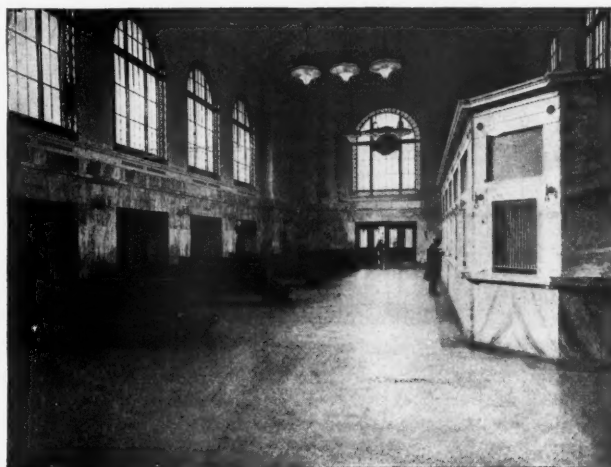
Missouri, Oklahoma & Gulf.—W. H. Trumbull & Co., bankers, of Boston and New York, have gotten up a very attractive, well illustrated report on the Missouri, Oklahoma & Gulf. The report contains a map of the United States showing the territory from which, it is expected, it will be found cheaper to ship by way of the gulf and Panama canal than by way of Atlantic or Pacific coast ports. A description of the products handled by the Missouri, Oklahoma & Gulf and a large map showing the character of the country through which the road runs, add to the value of the report.

Machine Tools.—The Hilles & Jones Co., Wilmington, Del., has issued its No. 7 catalogue, containing 225 pages, 12 in. x 9 in., bound in cloth board. This catalogue illustrates in half-tone and line cuts a complete line of machinery for working plates, bars and structural shapes. The book is a valuable addition to any library of machinery in this line, containing as it does detailed descriptions of the following: Vertical punching, shearing and straightening machines; machines for structural sections; single horizontal punches;

single horizontal bending machines; combined horizontal punches or shears; universal shears; machinery for bar, billet, double and single angle bar and plate shearing; multiple punches; plate bending and straightening rolls and plate planing machinery.

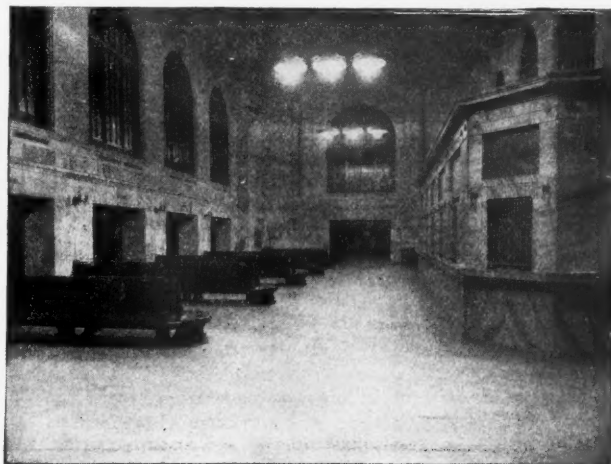
Illumination of a Railroad Station.

The accompanying illustrations show the main waiting room of the union station at Schenectady, N. Y., as it appears in the day time and at night. The waiting room is lighted



Daylight Illumination; Schenectady, N. Y., Union Station.

by high-current arc lamps of the General Electric Co., Schenectady, N. Y., equipped with concentric diffusers and opal shades, there being three fixtures suspended from the ceiling, each of which has three eight-ampere arc lamps. Each lamp is operated in multiple from the 60-cycle a.c. supply circuit. As auxiliaries to the main lighting units incandescent lights with frosted globes are supported beneath fixtures on the sides of the walls. The lower shade of the light opal glass directs the greater portion of the light against the under side of the porcelain covered metal reflector, which is slightly cone shaped and corrugated. The corrugations diffuse the light, the rays being directed outward and downward at every angle. The resulting illumination is a soft and restful light,



Night Illumination.

penetrating to all parts of the room. This method of lighting is said to be far superior to that of direct lighting which uses arc lamps without diffusers. Although the intensity of illumination with diffuser arc lamps is low, the lighting is amply sufficient for reading.

The illustrations show a part of the waiting room, which contains 4,532 sq. ft. The lighting is provided by nine arc lamps of 620 watts per lamp.

Cast Iron Caboose Jacks.

Sheet iron caboose jacks or chimneys are troublesome because they need almost constant repairing and frequent renewal. In the long run they are far more expensive than cast iron jacks, which will outlast a number of the sheet iron variety. The cast iron caboose jack shown herewith

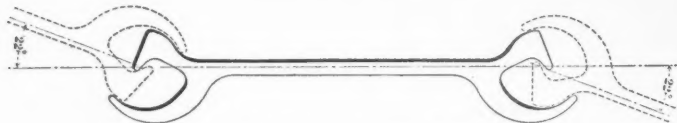


Dickinson Caboose Jack.

is $\frac{1}{4}$ in. thick, and is made in three pieces. All bolts, after being tightened, are riveted to insure the parts always being held together. The castings are designed to bring all of the wear on the cast iron parts and prevent the bolts rusting to such an extent as to allow the jack to come apart. A ventilating space is provided around the pipe at the roof line to ventilate the car. The jacks are held by bolts through the car roof. These bolts are made to a standard so that in case of accident to a chimney a new one can be applied in a few minutes. A skilled mechanic is not needed to do this as with a sheet iron chimney. Neither is asbestos packing or fireproofing needed, the cast iron ring, which projects from the roof castings, protecting the wood from fire. These jacks are made by Paul Dickinson, Incorporated, Chicago.

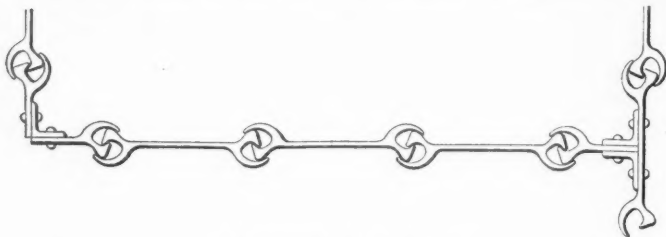
Lackawanna Steel Sheet Piling.

The Lackawanna Steel Co., New York, has recently placed on the market a new form of steel sheet piling. Each pile is a single piece complete in itself as it comes from the rolls, and requires no fabrication. The piling is a special rolled one-section bar, consisting of a web portion with flanges of like form at each edge, adapted to engage with similar flanges of an adjacent section. The piling will interlock with the



Detail of Lackawanna Steel Piling.

one previously driven. The line engravings represent clearly the form of the piling as rolled, and it will be noted that in this piling the flanges on the same side of the web are similar in design. The shorter flanges are hook-shaped and engage with the corresponding hooked flange of the adjacent section. The longer flanges are shaped to form a guard around the hook of the adjacent section. When the piling



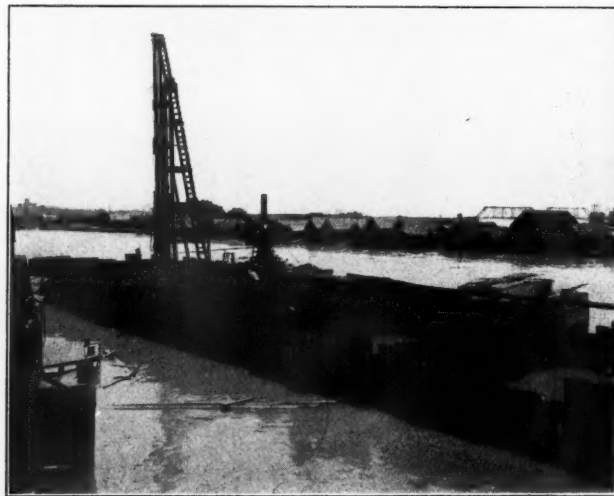
Lackawanna Steel Piling.

is driven the hooked flanges prevent longitudinal displacement, while the guard flanges prevent lateral displacement, and assist to prevent longitudinal displacement of the sections. The joint has three points of bearing which produce a positive and double interlock, firm and close, offering a rigid built-up wall, which withstands all strains, particularly the longitudinal and the side or buckling strains. At the same time this interlock, with a bearing on both sides of the

web, is such as to hold the piling in line while being driven, and to form a straight wall.

In the development of this bar by the Lackawanna Steel Co. special attention was given to the design of the flanges which form the interlock to secure for this joint the maximum strength against pulling apart while being driven, and at the same time to produce a form which should be simple, interlock perfectly, and have the material so distributed as to give the largest radius of gyration, and correspondingly high strength. The illustration shows the adopted sections, and before placing them on the market an experimental cofferdam was driven with 32-ft. lengths of $12\frac{3}{4}$ -in. sheet piling. The material enclosed was subsequently excavated in order to ascertain the condition of the piling after driving, and to determine its efficiency as a protection against leakage. The result of this experiment proved that the interlock was perfect, and that the joints were practically water tight. A series of tests were conducted to determine the strength of the interlock, and the average of these tests shows that with two $12\frac{3}{4}$ -in. sections interlocked the joint has, in tension, a value of 9,700 lbs. per lin. in. of bar. It is therefore a desirable pile for work in which high tension stresses exist.

A feature of this bar is the ability to turn various angles and still maintain a perfect interlock, the shape of the inter-



Cofferdam of Lackawanna Piling.

locking flanges and hooks permitting a change in a direction with a line of piling in case of the encountering of bowlders, etc. A piling of this character and form is specially adapted to the construction of retaining walls, foundations, cofferdams, submarine work, mine shafts, etc., where quicksand and water are encountered. An important feature of the Lackawanna piling is that when driven in ordinary soil, such as clay and quicksand, enough of the soil works into the joints to make them practically water tight. If driven in clear water the usual methods of packing, if necessary, may be employed to produce a water tight joint. On account of its simple form it has many advantages in handling and driving. The friction area in the interlock, being three narrow surfaces, is at a minimum, so the piling can be easily driven and withdrawn a number of times, and when it has outlived its usefulness the discarded material can be sold for scrap.

The table below shows the standard weights and widths of sections rolled:

A—Thickness of web.....	$\frac{1}{2}$ -in.	$\frac{3}{8}$ -in.	$\frac{1}{4}$ -in.
Weight per sq. ft. of wall.....	40.00 lbs.	35.00 lbs.	19.70 lbs.
B—Distance c. to c. of joints.....	$12\frac{3}{4}$ in.	$12\frac{3}{4}$ in.	7 in.
Weight, per lin. ft.....	42,500 lbs.	37,187 lbs.	11,500 lbs.
C—Width of joint over all.....	$3\frac{15}{16}$ in.	$3\frac{5}{8}$ in.	$1\frac{5}{8}$ in.

An ordinary pile driver is used, the head of the piling being fitted with an iron cap having a wooden cushion interposed between the iron cap and the hammer of the pile driver. In driving, satisfactory results have been obtained in keeping the vertical alinement of the bar. This is an important point, especially where a long wall is driven and long lengths are used. In the closing of rectangular pockets the vertical alinement must be true in order that the closing pile will drive freely for its full length and not strain the interlock. Fabri-

cated corners are formed by fitting the edges of two half sections at the desired angle by means of structural steel angles. Junction members for cross walls are made up of a full section, a half section and two angles riveted together. Both styles of fabricated corners are shown.

The 12 $\frac{3}{4}$ -in. bar has been adopted for the construction of the cofferdam for the new government ship lock in Black Rock Harbor, Niagara river, at Buffalo, N. Y. This lock when complete will be one of the largest ship canal locks in the world. Before selecting the piling to be used in this harbor improvement a series of tests were made, subject to United States Government inspection, in which several makes of piling were driven, and the results obtained from the Lackawanna bar were so satisfactory that the contractors adopted it for this extensive construction. This is the largest single order of steel sheet piling ever placed for government work, requiring 7,000 tons for the complete cofferdam. This cofferdam is 947 ft. long, 245 ft. wide outside dimensions at one end, and 260 ft. at the other end, and requires 44-ft. to 50-ft. lengths of piling. The wall of the cofferdam is made of two lines of piling 30 ft. apart, with division walls at 30-ft. intervals, forming 30-ft. pockets. Later these pockets will be filled with clay to form the solid wall of the cofferdam.

Coal and Ash Handling Gantry.

The accompanying illustrations show the I-beam bucket operated hoist mounted on a gantry, recently installed at the shops of the Wabash at Decatur, Ill. The gantry serves the cinder pits on either side of the tracks, and can be arranged for handling coal from cars to engine tenders. The general arrangement of machinery for driving the bridge is seen in the illustration. The motor drives direct into a gear casing, which is in the center of the machine and contains the first reduction gears. The shaft is extended and drives through a pair of bevel gears at each end of the gantry, down through the vertical shaft to the truck wheels. All of these gears

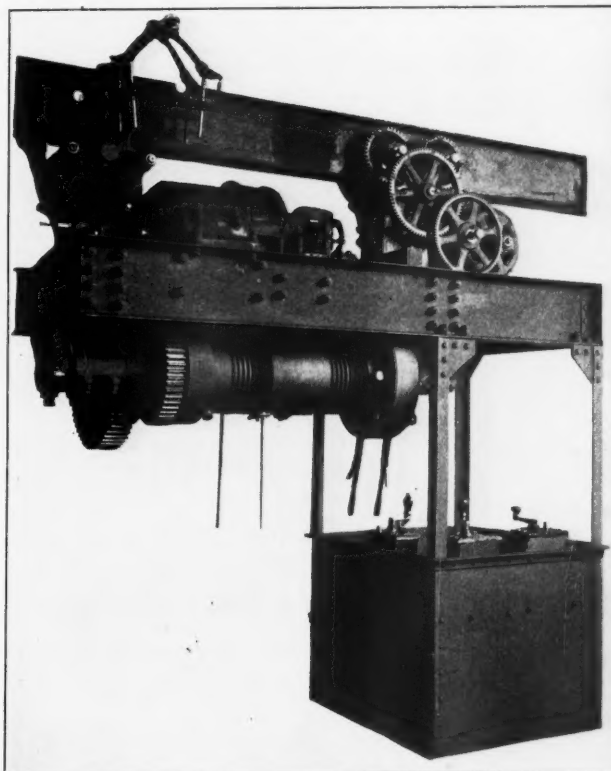


Case Traveling Gantry at Decatur, Ill.

are entirely enclosed in casings and provided with step bearings for vertical shafts. On account of the desirability of having this machine as light and compact as possible, all casings are of steel and the truck wheel frames are supported on ball-bearing with 2 $\frac{1}{2}$ -in. chrome steel pintle pins. In addition to this, a steel yoke is arranged to fit around the lower flange of the beam, so that if the pin should break, either

from long usage or crystallization, the yoke will prevent the hoist from falling.

The operation of this machine is simple. Assuming that the bucket is lowered open, the brake levers being in the central position, the operator immediately reverses the hoist controller which closes the bucket and the auxiliary drum automatically takes up the slack in the holding rope. When the bucket is closed and is drawn up, it is necessary to throw in the clutch lever, which makes both drums travel at the same speed. It is now possible to hoist or lower with the bucket



Hoisting Machinery and Operator's Cage.

closed, and when it is in the proper position for dumping, the brake lever may be set and the clutch lever released. By reversing the hoist controller, the operation is completed. To lower, it is necessary to set the clutch and reverse the brake lever.

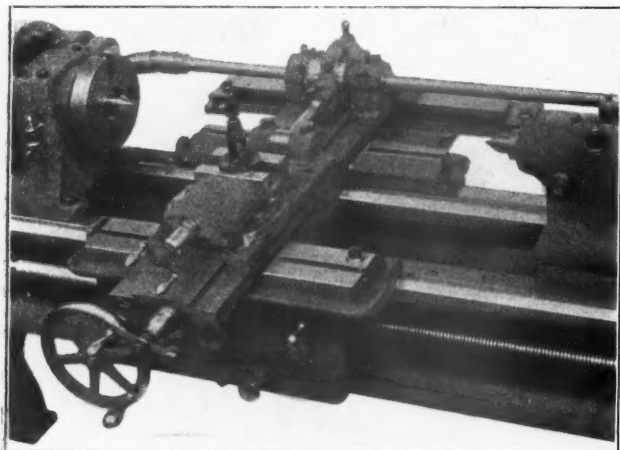
This machine is equipped with three 60-cycle, three-phase, a.c. motors, one for the bridge travel, one for hoisting and operating the bucket, and another one for traveling the trolley.

The grab bucket, of 2 cu. yds. capacity, is arranged with one closing and two holding ropes, which prevent any twisting or turning. The bucket operating mechanism is so arranged that the bucket can be hoisted or lowered either open or closed. The load is carried at all times through an automatic load brake which prevents dropping of the bucket through carelessness of the operator or temporary interruption of the current. The hoist is also provided with a limit switch which prevents any overtravel, and consequent damage to the bucket or machinery. The hoisting speed is about 75 ft. per minute, trolley speed from 150 ft. per minute to 250 ft. per minute, and the speed of gantry from 150 ft. per minute to 200 ft. per minute. The hoist is provided with steel wheels, which run on the lower flange of a standard I-beam, with steel gears throughout; two drums, and the necessary brakes for operating the auxiliary drum. The hoist is 9 ft. long over all, 5 ft. 6 in. from back of cage to center of hook, and 3 ft. 6 in. from center of hook to outside of truck wheel. The cage is attached direct to the trolley and contains the controllers, switch board and resistances. The cage dimensions are 3 ft. 3 in. long by 3 ft. 9 in. wide. It is 8 ft. 6 in. from the bottom of the cage to the bottom of the I-beam. The machine was built by the Case Manufacturing Co., Columbus, Ohio, which company is making a specialty of coal and ash handling plants.

Derrer Universal Shape Attachment.

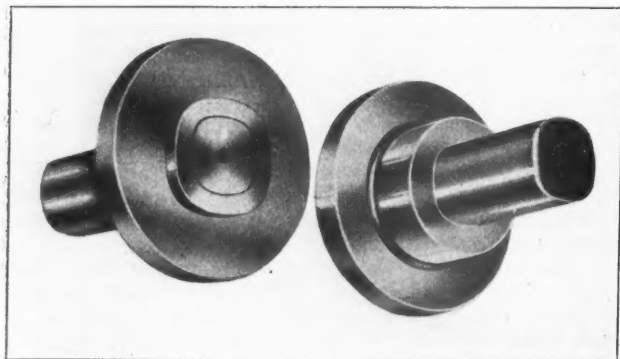
An interesting tool exhibit at the recent June conventions at Atlantic City was that of a three-step cone, double back-gear standard screw cutting engine lathe, upon which was mounted a Derrer universal shape attachment. This device makes it possible to turn or bore oval, square and odd shapes, either straight or tapered, for machine tools and parts.

The lengthened lathe spindle carries a gear which drives the splined shaft shown at the rear of the lathe. This shaft passes through the eccentrics and bearings, in which latter are sleeves which revolve with the shaft. Suitable gears are



Lathe with Derrer Attachment.

furnished to give this shaft the following speed ratios to those of the spindle: 1 to 1 for turning or boring eccentrics; 2 to 1 for ovals; 3 to 1 for cams, and 4 to 1 for squares. There are two eccentrics, one within the other. A graduated disc permits of an easy and quick adjustment to any desired throw from zero to the combined throw of both eccentrics. On a 16-in. lathe, this maximum is $\frac{1}{2}$ in. for ovals, squares and cams. For general work a solid, non-adjustable eccentric may be used. This arrangement is advantageous when a large quantity of duplicate parts is required. The eccentrics actuate the tool post through a bronze eccentric strap which is

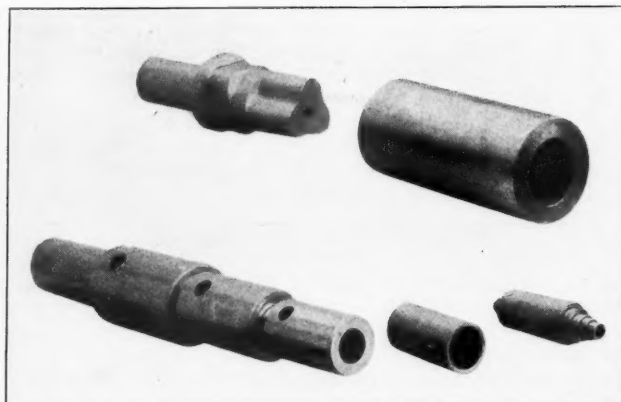


Shaft Coupling.

coupled to the compound rest slide. The bearing blocks for the eccentric shaft are cast integral with the long lower slide. This slide moves upon the bridge of the lathe carriage and extends out and over the taper attachment, where it is bolted to the shoe or sliding block on the taper dovetail.

The idea of a lathe attachment which will permit the turning and boring of odd shapes appeals especially to those who are familiar with the present common use of tapers for machine drill and reamer shanks and sockets, as well as the use of keys, set screws, splined shafts and other holding devices in the parts of machinery. The taper shanks of tools which are made round and held in position by the taper alone have not proved entirely satisfactory. The Derrer attachment provides for the turning of such shanks in oval and odd shapes, which, in addition to the taper, makes a firm holding device.

It is unnecessary to mill the flat tangs on these tools. This not only gives additional bearing surface for the shank in the socket but does away with the trouble incident to broken and twisted tangs, and gives additional bearing surface for the drift used in removing the tool from the shank of the machine spindle. The shaft coupling shown is a good example of the application of the square shape. The ends of the shafts are turned square and tapering to fit the coupling flanges which are bored to the same shape and taper. This method dispenses with the use of keys or set screws. Odd shaped rigid bearings of gears on shafts provide a true positive drive without the use of keys, which latter serve to weaken both the shaft and the gear center. Milling cutters, when secured to arbors by keys, are much weaker than those not using keys, since



Oval and Odd Shapes.

fine tool steel will crack first in the sharp corners. A square or oval arbor makes keys unnecessary.

The efficiency of the oval drive has, it is said, been demonstrated in the plant of the Algoma Steel Co., Ltd., Sault Ste. Marie, Ont., where it has been in use for some time. The Derrer universal shape attachment is made by the Lodge & Shipley Machine Tool Co., Cincinnati, Ohio, for the Lancaster Machine & Knife Works, Lancaster, N. Y., which latter company exhibited the attachment at the June conventions, together with a full line of its drills, drill sockets and sleeves. The oval shape is used on all these tools, having a taper of $\frac{3}{8}$ in. to the foot, which taper has been made the standard for all tools made by this company.

Railway Signal Association.

Secretary C. C. Rosenberg, Bethlehem, Pa., has issued the notice for the September meeting of this association, which is to be held at the Great Northern Hotel, Chicago, on Tuesday, the 8th, beginning at 10 a.m. There will be a paper on snow melting by James S. Lang; report of committee on specifications for pipe, for gray iron castings, for malleable iron castings, for machinery steel, and wrought iron bars, and for signal roundels. Accompanying the notice of the September meeting are advance copies of some of the reports to be presented at the annual meeting in October; namely, on specifications for mechanical interlocking; on specifications for electrical interlocking; on automatic stops and cab signals, and on storage batteries.

Oil Burning Mine Locomotive.

The Lehigh Valley Coal Co. employs in its mines many different methods of transporting coal, and the management has recently decided to experiment with the oil-burning locomotive. One has been installed in the mine known as Hazleton No. 1 and another at Seneca, Pa. With the increasing length of hauls, the expense of transportation in the mines has grown rapidly in the last few years, and it is hoped that the oil-burner will bring about an economy in this branch of the industry.

It is only in a mine free from gas that such an experiment can be made, for any form of combustion is dangerous where

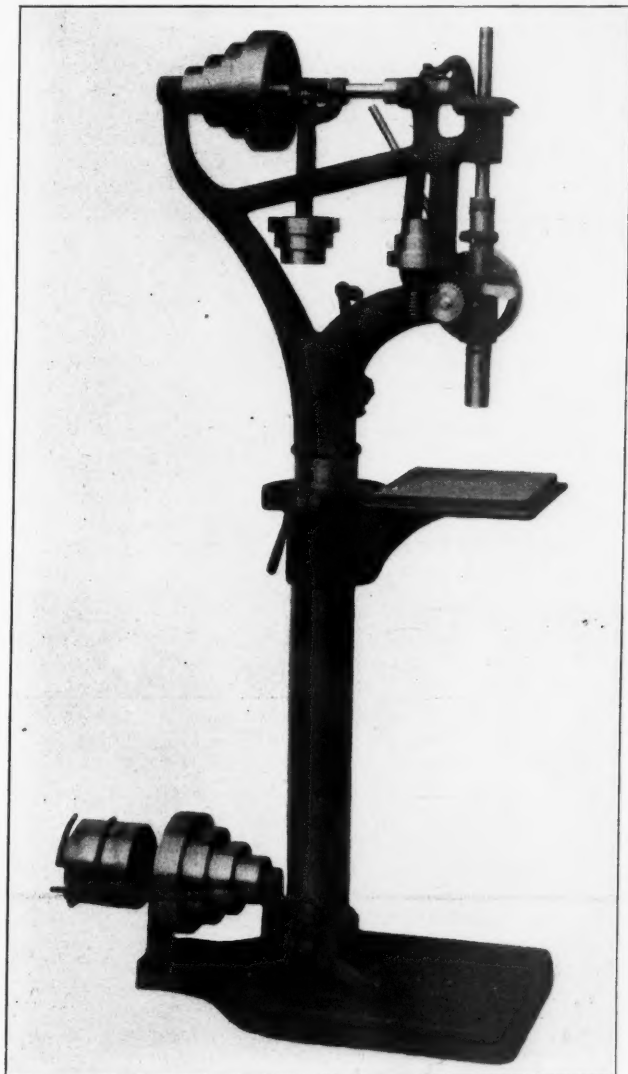
gas is present. Neither Hazleton No. 1 nor the Seneca mine is gaseous, so that the locomotive can be operated with perfect safety in either. In gangways where gas may be encountered, compressed air is the preferred mechanical power, even electricity being considered dangerous by a great many mining men. The advantage of oil as a fuel, for use in the mines, is that its combustion creates no fumes and the smoke from it is a negligible quantity.

The oil-burner at Hazleton No. 1 weighs 15,500 lbs., is 15 ft. long and 5 ft. high. It has four driving wheels 24 in. in diameter and runs on a 42-in. gage track. It is built to occupy as little space as possible. The top of the stack is on a line with the top of the boiler.

The oil-burner at Seneca is practically the same as the one at Hazleton, No. 1, except that it is but 36-in. gage. Either of the two is capable of hauling from 12 to 15 loaded mine cars up a 3 per cent. grade and is expected to do the work of 10 mules.

Power Feed Attachment.

The Hoefer Manufacturing Co., Freeport, Ill., has designed a new power feed attachment, illustrated herewith, for its line of 16-in. drills. It departs somewhat from this company's regular method of attaching power feeds, with quite satisfactory results, it is claimed. The power feed is simple and effective. Two worms are used to reduce the speed of the upper shafts to a suitable feed for the spindle. The pulleys are placed vertically. To engage the feed a small lever is thrown upward, bringing the worm and worm wheel together. There is a trip on the sieve of the spindle and the power

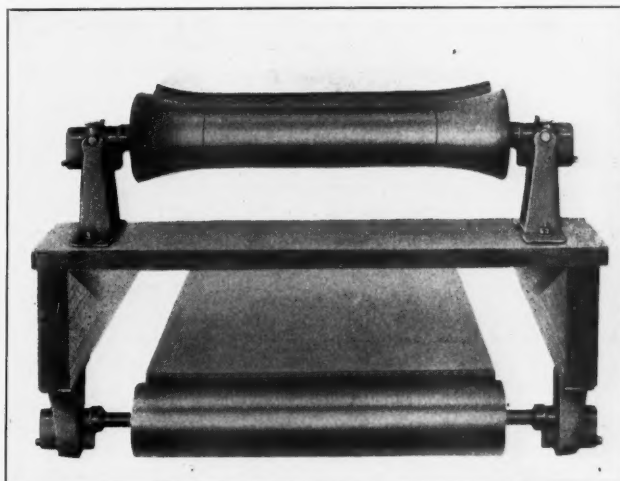


Hoefer 16-in. Drill.

feed may be quickly and easily thrown out. The speeds of the feed on the 16-in. drill are .004 in., .008 in. and .012 in. per revolution of spindle, which has proven ample for all purposes. The convenience of the lever feed has not been sacrificed in attaching this power feed, the right-hand being free to use the lever feed if desired.

Steel Troughing and Return Rolls.

The question of troughing conveyor belts has caused controversy, and about the only point that seems to have been definitely settled is that with deep troughing-rolls the belt must be made so that it will bend to the required shape. For the ordinary multiple pulley idler, the belt is sometimes made with fewer plies of fabric at the middle part to obtain this shape. The rubber protective cover of the belt has little or no tensile strength. The result of decreasing the plies at



Steel Conveyor Belt and Rolls.

the center weakens the fabric, especially in wide belts designed for large carrying capacities, and at the very point where the load is heaviest and the bending of the belt most severe. With belts in constant use, this results in quick wear and early renewals.

The improved pressed-steel type is shown in the illustration. The carrying-roll, secured to the through shaft which revolves in self-oiling, dust-tight bearings, consists of three parts rigidly fastened together, one straight middle section and two bell-shaped end sections. The inner edges of the end section are flanged so that the center section overlaps, making a perfect joint and a well balanced roll. The closed ends prevent the entrance of material to interfere with the rotation of the roll or throw it out of balance. The clear height above the supporting plank effectually removes the roll from possible contact with spilled material. The carrying-run is over a one-piece roll on which the loaded belt bears evenly for its entire width. All troughing strain is eliminated, the belt wear being confined to the ordinary carrying service.

The return rolls are of the one-piece, straight-face type, set-screwed to the through shaft which revolves in bearings identical with those on the carrying run. The rolls are compact, light and strong, and in service under severe conditions show great durability. The lightness and simplicity of construction have so reduced the initial cost that closer spacing is possible, and where high speeds and large capacities are desired this prevents sagging of the belt and assures smooth, easy operation, less horse-power consumption, and a minimum of belt wear. The rolls being fixed to the shafts which revolve in oil, have but two lubricating points, which are easily accessible.

The following principles may be applied for belt conveyors: (1) Belts should be applied only to uses for which they are especially adapted, there being no so-called universal conveyor. (2) The more nearly a belt conveyor approaches the flat type, the longer the belt will last, therefore, the troughing should be sufficiently shallow to allow the belt to lie as nearly flat as possible and without strain. (3) Every belt,

whatever its construction, should be uniformly strong throughout its width; the composition should be governed entirely by the material to be handled and the conditions under which the conveyor must run. These features are claimed to be successfully incorporated in this improved pressed steel type belt of the Link Belt Co., Nicetown, Pa.

Crossing Bell and Block Signal Relays.

The glass-enclosed combined interlocking and block signal relay, of the Railroad Supply Co., Chicago, is illustrated herewith. A large number are in service, with satisfactory results, it is claimed, the device having been on the market for about a year. Fig. 1 shows the instrument in its simplest form, when used as an interlocking relay only. All working parts of the relay are glass-enclosed. The glass cover has a very soft, pure Para rubber gasket and is held in place, air tight, by two lock nuts which have a seal similar to an ordinary car seal. Each relay is tested at the factory and must pass two inspectors before being allowed to be sealed.

The interlocking feature of this relay is identical with that on this company's style H relay, which has been on the market for a dozen years. But material improvement has been made in the carrying capacity of the interlocking contacts on the new relay. All contact fingers consist of three separate platinum contacts mounted on German silver springs. The armatures are brass-bushed where the German silver trunnion screws enter for pivot. The coils are form-wound on brass spools and are furnished in any desired resistance. All parts of the relay are on top of the enameled slate base, nothing protruding to the under side of the same. A thin brass strip is attached to the binding posts which passes into the glass case between the rubber gasket and the slate base. All connections are, therefore, on top of the relay, in plain sight. It is impossible to tamper with any of the connections on the inside of the relay without breaking the seal.

Fig. 2 shows the same relay with four extra front and four extra back contacts for the control of block signal or other circuits, making the relay applicable within block signal territory. In these relays all contacts are interchangeable, the contact supports being drilled and fitted to receive any style of contact furnished with the relays, which may be platinum, graphite, silver plated graphite, of the flat pattern, or of the circular pattern. The contacts and all parts of this interlocking relay are also interchangeable with this company's regular track relays. This relay is said to comply in all details

as to pick-up and release, water immersion test, $\frac{3}{8}$ -in. air gap, form-wound coils, etc., with the specifications of The Railway Signal Association, making it acceptable to most railroad signal departments for joint work, whether automatic electric signaling or highway crossing alarms.

The Railroad Supply Co. makes a weatherproof iron relay box to hold this relay. It is so made that when opened all sides of the relay are exposed, the front and three sides of the box being hinged on the bottom, which serves as a shelf to hold the relay. The company also makes a double relay box for this relay; heavy and substantial and wood lined. It is large enough to hold two of the interlocking relays or any four-block signal relays on the market.

An Automatic Highway Crossing Gate.

There is now in use at Stokesland, Va., on the Danville & Western, a highway crossing gate which is automatically lowered and raised by compressed air, the power being applied

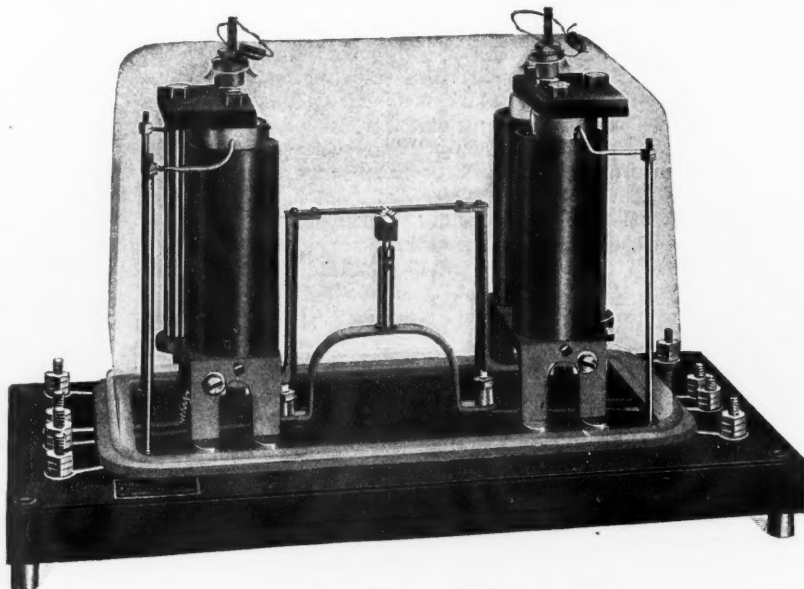


Fig. 1—Interlocking Relay.

or shut off by the action of the trains. At a suitable point approaching the crossing there is an air compressing device, and a train approaching the crossing both compresses the air and causes its application for lowering the gates at the crossing. After passing beyond the crossing, the train, by a similar device, causes the gates to be raised. The gate was put up by the Fitzgerald Automatic Gate & Signal Co., of Danville, Va. Mr. Fitzgerald and Mr. T. S. Williamson, who is President of the company, recently exhibited the operation of the gate to a party of railroad officers.

Hy-Rib Sheathing.

"Hy-Rib" sheathing is a new material for reinforced concrete construction. It is made from open-hearth rolled steel plates, and consists of a series of rigid high ribs, $\frac{1}{8}$ in. high and $3\frac{1}{2}$ in. apart, rigidly connected by rib-lath. The ribs and lath are made from a single sheet of steel. The purpose of the ribs is to give the necessary strength and rigidity to make the sheathing self-centering for floors and roofs, and do away with the studs in wall and partition construction. The rib-lath gives a good plastering surface, and locates and holds the ribs firmly in place. A full-size rib along each side of a sheet enables the sheets to be interlocked by overlapping. The self-centering feature has been mentioned. The sheathing is simply laid over the supports and the concrete poured from above. It flows through the sheathing enough to form the necessary clinch

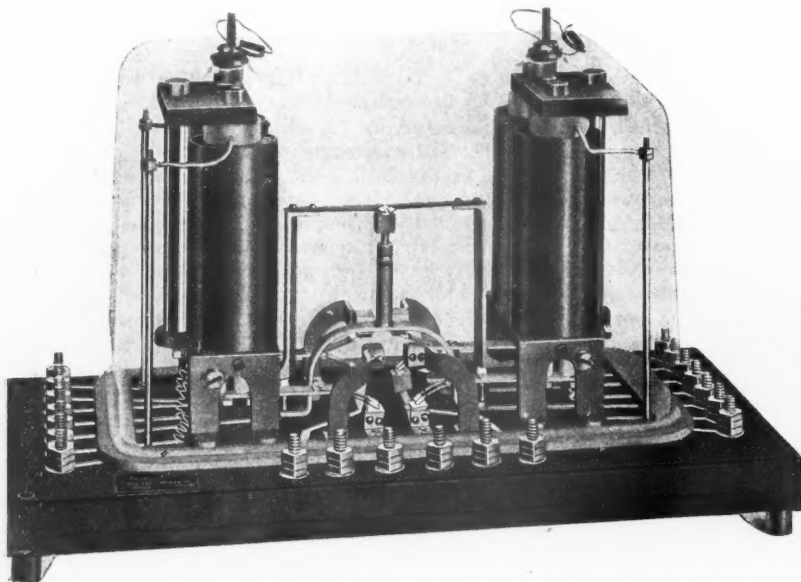
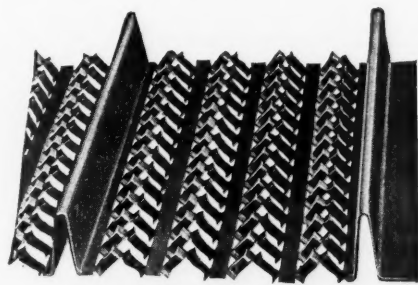


Fig. 2—Combined Interlocking and Signal Relay.

and key. Plastering is applied directly to the under surface. For long spans and heavy warehouse floors the sheathing is bent to arch form. For walls the sheathing is simply set up and plastered on both sides, the wall then being complete. Other



Hy-Rib Sheathing.

uses are, for furring the outside or inside of building walls to make them damp-proof; and for suspended ceiling construction, doing away with channels or tees, except as used for supports, spaced about 5 ft. apart. The sheathing is supplied in sheets 10½ in. wide, center to center of outside ribs, in lengths of 6, 8 and 10 ft. There are four thicknesses—Nos. 30, 28, 26 and 24, U. S. standard gage. It is made by the Trussed Concrete Steel Co., Detroit, Mich.

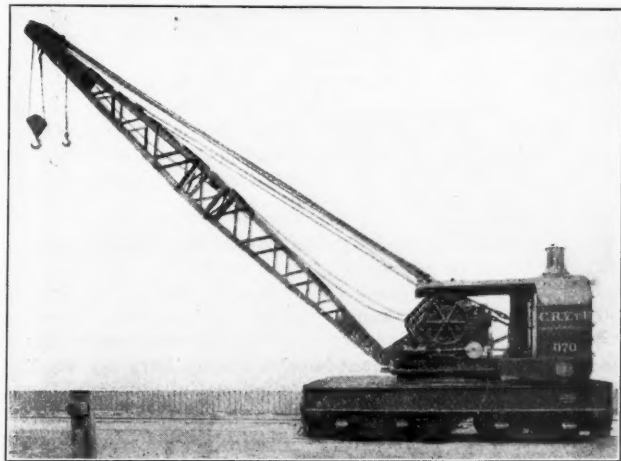
Chicago Pneumatic Tool Co.'s Semi-Annual Report.

The Chicago Pneumatic Tool Co., which has an issued capital stock of \$6,485,800, shows a net profit of \$102,836 for the half year ended June 30, 1908. This net is taken after deducting \$47,122 for depreciation and development of new tools. President J. W. Duntley in submitting the semi-annual report says: "The business during this period shows a falling off of 46 per cent., owing to the prevailing depression in the iron and steel industries, and its showing of earnings is therefore greatly reduced.

"Notwithstanding the prevailing depression and decreased business, the company has reduced its indebtedness, included in mortgage assumed, bills payable and accounts payable, \$123,000, and has in addition met all of its fixed charges, and a balance of \$18,086 has been added to surplus account."

Wreck Crane for Bridge Construction.

The crane illustrated herewith was bought by the Southern Pacific Company for the Cananea, Yaqui River & Pacific Railroad and shipped to San Blas, Sinaloa, Mex. The crane is intended principally for bridge erection purposes, and is designed to handle 60-ft. girders weighing 19 tons at a radius



Wreck Crane for Bridge Construction.

of 45 ft. 7 in. The crane will swing a full revolution and can handle bridge material from cars on the same track or from cars on parallel tracks, placing the members in their proper position in the bridge. The crane is self-propelling and will develop a speed of six miles per hour under its own steam. It has a boiler and engines of large capacity, and can perform the functions of traveling, slewing and raising or lowering its load independently or simultaneously. It is equipped with two hoisting drums for main and auxiliary hoist. When

not needed for construction work the special boom is removed and the regulation wrecking crane boom substituted. In this condition the crane will handle loads of 90 tons at 16 ft. radius. It was built by the Industrial Works, Bay City, Mich.

Railroad Officers.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Myron J. Carpenter has been appointed receiver of the Southern Indiana, with office at Chicago. The officers of the road retained their former positions.

Operating Officers.

J. D. Brennan, Trainmaster of the Illinois Central at Champaign, Ill., has been appointed Trainmaster of the Gulf division of the International & Great Northern at Palestine, Tex.

H. W. McMaster, one of the two receivers of the Wabash-Pittsburgh Terminal and West Side Belt, has been appointed General Manager, with entire charge of traffic, operation and maintenance.

H. H. Brewer, Superintendent of the Lake Superior division of the Grand Trunk Pacific, has been appointed General Superintendent, with office at Winnipeg, Man., succeeding O. O. Winter, resigned.

L. E. McClure, Chief Train Despatcher of the Chicago, Rock Island & Pacific, has been appointed Trainmaster of that road, with headquarters at Little Rock, Ark., succeeding J. E. Votaw, resigned. J. E. Quigley, Night Despatcher, succeeds Mr. McClure, and J. Elwood succeeds Mr. Quigley.

Traffic Officers.

T. P. White has been appointed Car Service Agent of the Grand Trunk Pacific, with office at Winnipeg, Man.

E. P. Cockrell has been appointed Assistant General Passenger Agent of the Chicago, Indianapolis & Louisville.

H. G. Duke has been appointed Traveling Freight Agent of the Southern Railway at Montgomery, Ala., succeeding G. N. Quigley, resigned.

F. W. Kirtland has been appointed Assistant General Freight Agent of the Florida East Coast at St. Augustine, Fla., succeeding G. C. Floyd, transferred.

W. O. Rock has been appointed Division Passenger Agent of the Erie, at New York, succeeding H. W. Hawley. This corrects a recent item in these columns.

C. H. Hunt, heretofore Westbound Agent of the Delaware, Lackawanna & Western, has been appointed Commercial Agent of this road, with headquarters at St. Louis, Mo.

S. G. Beckley, Assistant General Eastern Agent of the Kanawha Despatch, has been appointed General Eastern Agent, with office in New York, succeeding A. G. Troup, resigned.

B. F. Wyly, Jr., Traffic Manager of the Lackawanna & Wyoming Valley, with office at Scranton, Pa., has resigned to become District Manager at Montgomery, Ala., of the Southern States Life Insurance Co., of Atlanta, Ga.

E. S. Jacobs, whose resignation as General Agent of the Quincy, Omaha & Kansas City was announced in these columns, has been appointed Chief Clerk in the General Freight and Passenger Agent's office at Kansas City, Mo.

C. S. Orcutt, Traveling Freight and Passenger Agent of the Wabash at San Francisco, Cal., has been appointed General Agent at that place, succeeding L. R. Robinson, who has been appointed Assistant General Manager of the Canadian Pacific Despatch, with office at Boston, Mass. C. S. Arnold, Contracting Agent of the Wabash in San Francisco, succeeds Mr. Orcutt.

W. F. Schmidt, Industrial Commissioner of the Wabash, has been appointed Assistant General Freight Agent at St. Louis, Mo. H. E. Watts, Division Freight and Passenger

Agent at Moberly, Mo., has been appointed Assistant General Freight Agent at St. Louis, Mo. W. A. Hopkins, Commercial Agent at Salt Lake City, Utah, succeeds Mr. Watts at St. Louis. J. L. Yundt, Traveling Freight Agent at Salt Lake City, succeeds Mr. Hopkins.

The headquarters of W. A. Beckler, who has been appointed Assistant General Passenger Agent of the Cincinnati, New Orleans & Texas Pacific, the Alabama Great Southern, the Alabama & Vicksburg, the Vicksburg, Shreveport & Pacific and the New Orleans & North-Eastern, will be in Cincinnati instead of in Chicago, as was erroneously reported by this paper in its issue of August 21. A. J. Lytle succeeds Mr. Beckler as Northern Passenger Agent of these roads, with headquarters at Chicago.

W. H. Quigg, Assistant General Freight Agent of the New Orleans & Northeastern, the Atlanta & Vicksburg, and the Vicksburg, Shreveport & Pacific at New Orleans, has been appointed General Freight Agent of the Atlanta, Birmingham & Atlantic, with office at Atlanta, Ga., succeeding J. J. Campion, resigned. J. B. Bannon, Assistant Freight Agent of the N. O. & N. E., the A. & V. and the V., S. & P. at New Orleans, succeeds Mr. Quigg, and A. J. Chapman, Assistant General Agent at Shreveport, La., succeeds Mr. Bannon. These appointments are effective September 1.

W. H. Abel, Division Passenger Agent of the Chicago & Alton at Springfield, Ill., has been appointed Assistant General Passenger Agent at Kansas City, Mo., succeeding T. J. Burns, Sr., retired. C. R. Murray, Division Passenger Agent at Mexico, Mo., succeeds Mr. Abel and A. D. Perry succeeds Mr. Murray. Thomas Drennan has been appointed General Agent at Streator, Ill., his jurisdiction extending over the Dwight branch and over the main line from Dwight to Joliet. R. A. Guest has been appointed Passenger and Ticket Agent at Springfield, Ill., succeeding E. Wilson, resigned.

Engineering and Rolling Stock Officers.

W. M. Saxton has been appointed Locomotive Foreman of the Grand Trunk Pacific at Biggar, Sask.

N. E. Baker has been appointed Signal Engineer of the Illinois Central, succeeding M. H. Hovey, resigned.

E. F. Jones has been appointed Acting Master Mechanic of the Chicago & Western Indiana and the Belt Railway of Chicago, in place of P. H. Peck, who has been granted a leave of absence.

G. W. Taylor, Master Mechanic of the Atchison, Topeka & Santa Fe at Newton, Kan., has been appointed Superintendent of Motive Power of the San Antonio & Aransas Pass, with headquarters at San Antonio, Tex.

Storekeepers.

H. J. Ackworth has been appointed Storekeeper of the Erie at Kent, Ohio, succeeding H. E. Lind, transferred.

C. B. Williams has been appointed General Storekeeper of the Central of New Jersey, with office at Elizabethport, N. J., succeeding W. F. Girtan, resigned.

OBITUARY.

R. S. Quigley, formerly Superintendent of the Hocking Valley, died at Columbus, Ohio, on August 17 at the age of 43 years. Mr. Quigley began railroad work in 1881. From that year until 1883 he was consecutively telegraph operator, train dispatcher's copier and Car Distributor of the Cleveland, Columbus, Cincinnati & Indianapolis, and from the latter date until 1890 he was Train Dispatcher of the same road. He became Train Dispatcher of the Cleveland, Lorain & Wheeling in 1890 and in 1891 was appointed Train Dispatcher of the Chicago & Eastern Illinois. Later in the same year he became Chief Train Dispatcher of the latter road and from May, 1892, to May, 1896, was Trainmaster of the Hocking division of the Columbus, Hocking Valley & Toledo, now the Hocking Valley. On the latter date he became Trainmaster of the Hocking Valley, and in September, 1901, was appointed Superintendent of the Hocking Valley, which position he held until May, 1908, when he was forced to take an indefinite leave of absence on account of ill health.

Railroad Construction.

New Incorporations, Surveys, Etc.

AKRON, CANTON & YOUNGSTOWN.—This company was incorporated in 1907 with \$200,000 capital to build a line to connect Akron, Ohio, with Canton and Youngstown. Announcement has been made recently of the company's plans which show that it proposes to build from Akron, Ohio, southeast eight miles to Mogadore. The project is backed by Canton and eastern capitalists, including Z. W. Davis and I. H. Taylor.

ALBIA INTERURBAN.—A contract has been given to Patrick Fitzgerald, of Atlantic, Iowa, to build an extension from Albia, Iowa, northwest about six miles to Hiteman.

ALTUS, ROSSWELL & EL PASO.—An officer writes that contracts are being let for the construction of the line that is building from Altus, Okla., west to Hollis, 40 miles, over the grade which has just been finished. The line is to be laid with 60 to 65 lbs. rail. The first bridge will be over the Salt fork of Red river, four miles west of Altus, consisting of a pile trestle 1,700 ft. long; the average bridging, including this trestle, will be 150 ft. per mile, between Altus and Hollis. Edward Kennedy, President, and H. Fielder, Chief Engineer, Altus.

ATLANTA NORTHEASTERN (ELECTRIC).—This company, it is said, has been granted a charter. It was organized to build about 40 miles of railroad in Georgia, for which surveys are made. The company is capitalized at \$50,000, and the incorporators include: T. F. Martin, of Atlanta, Ga.; J. P. Brooke, Alpharetta; C. C. Foster, Roswell; W. R. Otwell, of Cumming, and T. C. Tate, of Jasper. (July 17, p. 553.)

BILLINGS & COOKE CITY ELECTRIC.—This company is being organized with \$3,000,000 capital to build a line from Absarokee, Mont., northeast to Billings. Surveys are now being made and grading will begin as soon as the right of way is secured. J. B. Clayberg, Helena, Mont.; George E. Savage, Butte; A. L. Babcock, Theodore Martin and Bert G. Shorey, Billings; M. E. Estep, Chicago; Thomas Harney, Galena, Ill., and E. M. Hosky of Helena are interested.

BURR'S FERRY, BROWDALE & CHESTER.—It is said that this road will be extended to Brown del, Tex., about 35 miles from Rockland, and that track laying will begin about October 1. The grading and bridging is completed, and it is expected that the new extension will be in operation by January, 1909. (Aug. 14, p. 740.)

CHAMPLAIN & SANFORD.—A certificate of convenience and necessity, it is said, has been granted this company by the New York up-state Public Service Commission. The company was organized this spring to build a line from Addison Junction, N. Y., northwest to the east shore of Sanford Lake, about 35 miles. The incorporators include J. M. Thompson, R. L. Parker, G. T. Hills, A. B. Jones and MacNaughton Milles, with office in the Home Savings Bank Building, Albany, N. Y. (R. R. G., May 8, p. 655.)

CHICAGO, MILWAUKEE & ST. PAUL.—After a trip of inspection over the entire main line of this system, President A. J. Earling is reported to have spoke of work on the Pacific extension as follows: Our most immediate hurry is to get the main line through to the coast. We are now operating the line as far west as Butte, Mont. From there on to Puget Sound construction is progressing satisfactorily. Several stretches of track are already laid—one section 95 miles long and another 20 miles. With the exception of the tunnel through the Bitter Root mountains, we expect the tracks to be all laid by January, 1909. The tunnel should be completed April 1, 1909, and by July 1 we ought to be ready for freight traffic. The construction of switches, engine sheds and such accessories will prevent our hauling freight much before that date. The Tacoma work, I understand, is well in hand. Dredging and grading are being carried on rapidly. The other improvements will be commenced as soon as the C and Front street franchises are passed by the city council. (July 31, p. 647.)

CHICAGO, ROCK ISLAND & PACIFIC.—See St. Louis, Brownsville & Mexico.

DETROIT, FLINT & SAGINAW.—Incorporated with a capital of \$106,000 to complete the line between Saginaw, Mich., and Flint, with a branch to Vassar. This line was recently sold to Isaac Applebaum and N. A. Tabor, of Detroit.

GEORGIA & FLORIDA.—E. L. Bemiss, of Richmond, Va., President of the Augusta Construction Co., which is building the several connecting links required for the completion of the new system, is quoted as to the progress of the work as follows: Within the next ten days connection will be made between the Georgia & Florida lines and the Seaboard Air Line at Madison, Fla. The Valdosta Southern division, from Madison north to Valdosta, Ga., 28 miles, has had its grades cut down and a number of trestles filled, including one 32 ft. high. From Valdosta north to Nashville one of the new links, 30 miles long, is nearing completion, and it is expected trains will be operated on regular schedule over this section by Sept. 10. North of Nashville to Douglas, 38 miles, there have been several revisional lines run off the old right of way which have reduced grades and taken out curves. The work on this section is now over 60 per cent. completed, and at present admits easy operation and will be entirely standardized by the first of the year. From Douglas toward Hazlehurst the roadbed work on a 9½-mile cut-off has been completed, and on Sept. 1 rails will be laid on this and it will take the place of the present line of 18 miles, shortening the distance about nine miles. Between the end of this cut-off and Hazlehurst, 20 miles, a new roadbed is very nearly finished. The contract calls for its completion by Sept. 10. Before the end of the year it is expected that all of the line from Hazlehurst, Ga., south to Madison, Fla., will be finally connected up and relaid with heavy rail. In this division there will be 120 miles of main line, with 23 miles of branches.

Work north of Hazlehurst has been begun, and the roadbed on the first seven miles to the Altamaha river will be completed by Sept. 1. Bids for construction of the bridge were handed in on the 13th, and contract for this work is to be let soon.

It is expected that the directors will also arrange to push vigorously to completion work on the line between the Altamaha river and Vidalia, 20 miles. When this work is completed all the original roads will practically be in physical connection, making it possible to operate the road from Keysville, a point on the Augusta Southern, about 25 miles southwest from Augusta, Ga., to Madison, Fla., bringing the southern division of 143 miles in connection with the northern division of 119 miles. There will then remain about 26 miles more of construction from Keysville, Ga., to Augusta, Ga., to complete the system. Until this last section is built the Georgia & Florida can get access to Augusta over an existing line. (Aug. 21, p. 788.)

INTERCOLONIAL.—It is reported that surveys will be completed as soon as possible for the double-tracking of this line between Halifax, N. S., and Moncton, N. B. A survey is now being made between Truro, N. S., and Moncton, N. B., and will be completed shortly. (R. R. G., March 13, p. 396.)

IOWA INTERSTATE.—Organized by Des Moines citizens to build a road from Council Bluffs, Iowa, to Muscatine, by way of Des Moines. R. B. Bannister, Secretary and Treasurer, is credited with having said that all financial needs have been provided and in all probability actual construction will be begun this fall. The offices of the company are at 511 Manhattan building, Des Moines, Ia.

KANSAS CITY, MEXICO & ORIENT.—Officers in Oklahoma are quoted as saying that trains will be running between Kansas City, Mo., and Chillicothe, Tex., by September 1, and into Sweetwater, Tex., by November 1. The Red river bridge south of Altus, Okla., is nearly completed. (June 26, page 409.)

It is stated that A. E. Stilwell, President of this road, has raised nearly \$2,000,000 in London to be used in construction work in Mexico and Texas. Preparations are being made to increase the construction forces in Mexico.

MARSHALL & EAST TEXAS.—See Texas Southern.

MATANE & GASPE.—A contract is reported let by this company to H. J. Beemer & Co., of Quebec, for building 35 miles of line, with sidings. Senator Choquette is President.

NEBRASKA, KANSAS & SOUTHERN.—F. T. Burnham, Secretary of this company, is quoted as saying that financial arrangements have been made to build a line projected from Superior, Neb., southwest through Kansas to Garden City, 267 miles. An office is shortly to be opened at Garden City, and it is expected to begin the preliminary surveys soon. (R. R. G., May 15, p. 687.)

OKLAHOMA CITY, EL RENO ELECTRIC INTERURBAN.—Scott Jones, President, Chickasaw, Okla., has announced that it is expected grading will begin about November 15. Surveys, right of way and franchises are now being secured. It is proposed to build this line from Chickasaw, Okla., southeast to Sulphur.

QUITMAN & GREAT NORTHERN.—A company is being organized to build a line from Mineola, Wood county, Tex., north through Hopkins and Delta counties, to Paris in Lamar county, about 75 miles. The line is to be a coal and lumber road. The promoters want to hear from a construction company to join in the enterprise. Surveys are now being made and right of way secured. About \$150,000 in subsidies are assured, and about 45 miles of completed grade will be used. William Lloyd, President; M. J. Healey, Assistant to President and General Manager; T. A. Stephen, Vice-President, and J. W. Smart, Secretary and Treasurer, Quitman, Tex.

ROCHESTER, CORNING-ELMIRA TRACTION.—The Chief Engineer is quoted as saying that grading has been about finished from Conesus Lake, N. Y., south to Groveland, seven miles, and that similar work will soon be under way from Rochester to Lakeville, 25 miles. The company was organized to operate a line from Rochester, N. Y., southeast to Elmira, 120 miles. The line is to be double-tracked and laid with 70-lb. rails, with overhead catenary type construction for single-phase operation. The Rochester & Southern Construction Co., of Rochester, N. Y., has the general contract to build and equip the line. (R. R. G., May 22, p. 718.)

ST. FRANCIS & SOUTHWESTERN.—It is said that this road has given a contract for grading a line from Benkelman, Colo., to Stratton, where a connection will be made with the Chicago, Rock Island & Pacific. Work is to begin at once.

ST. LOUIS & SAN FRANCISCO.—See St. Louis, Brownsville & Mexico.

ST. LOUIS, BROWNSVILLE & MEXICO.—A press report from Kingsville, Tex., says that this road is soon to pass into the hands of the Chicago, Rock Island & Pacific and the St. Louis & San Francisco interests, and that it is planned to extend the line south from Brownsville, Tex., to Tampico, Mex.

TEXAS SOUTHERN.—A. T. Perkins, of St. Louis, Mo., representing the St. Louis Trust Co., is quoted as saying that the property of this railroad, recently purchased by O. Goodwin, J. F. Strickland, E. Key and the St. Louis Trust Co., has been turned over to them, and that they will commence repairs on the line as soon as possible. The name of the road will be changed to Marshall & East Texas, charter being filed at Austin, Tex.

THUNDER CREEK TRANSPORTATION & SMELTING CO.—Incorporated with a capital stock of \$3,000,000, to build a line from the Thunder Creek mining district in Skagit and Whatcom counties, Washington, to a connection on the Great Northern. A. M. Richards, President, Tacoma, Wash., W. W. Shenk, F. S. Blattner, Charles E. Phoenix of Seattle, and George Senior of Bellingham, Directors.

WASCO COUNTY ELECTRIC & WATER POWER CO.—An officer of the Portland Construction Co., Portland, Ore., which company has the contract for building this line, a total of about 200 miles, writes that construction of the first 40 miles of the road was commenced on August 15. Track laying will probably not be undertaken until April, 1909. A contract for a portion of the bridge and structural steel work has already been let. Letting contracts for the construction of dams, etc., are now under consideration. Actual construction work on the line must begin about September 1. There will be two power dams and plants of steel and concrete construction, one on the John Day river, the other on the Deschutes. The John Day plant will have a capacity of about 20,000 h.p. and the Deschutes plant about 60,000 h.p. (July 24, p. 601.)

Railroad Financial News.

ATCHISON, TOPEKA & SANTA FE.—The Transcontinental Short line first mortgage 4 per cent. 50-year bonds of which J. P. Morgan, New York, and Drexel & Co., Philadelphia, Pa., are offering \$17,000,000 at 94½, are secured by a total mileage of 694.86 miles. This mileage is made up as follows:

The Pecos & Northern Texas:	
Amarillo, Tex., to Texico, N. Mex.....	94.5 miles.
With branch, Canyon City, Tex., to Plainview.....	57.3 "
The Pecos Valley & Northeastern:	
Cameo, N. Mex., to state line Texas.....	208.19 "
The Pecos River Railroad:	
State line to Pecos.....	54.27 "
The Eastern of New Mexico:	
Texico to Rio Puerco, N. Mex.....	268.07 "
With branch to Cameo.....	8.97 "
and Sandia.....	3.56 "

The remaining bonds of the authorized \$30,000,000 can only be issued at the rate of \$25,000 per mile of newly acquired or constructed line.

CANADIAN NORTHERN.—This company has filed a mortgage dated July 1, 1907, securing £1,027,400 (\$5,137,000) first mortgage 4 per cent. land grant debenture stock and bonds.

CINCINNATI, HAMILTON & DAYTON.—The coupons due July 1, 1908, on the second (now first) mortgage 4½ per cent. bonds will be paid at the office of J. P. Morgan & Co.

DENVER & RIO GRANDE.—A special meeting of the stockholders of this new company, which on August 1 took over the old Denver & Rio Grande and the Rio Grande Western, has been called for September 10. The stockholders will be asked to authorize \$150,000,000 50-year bonds and \$15,000,000 three-year notes, to be secured by a deposit of the new bonds and convertible into these bonds. The notes, when authorized, are to be issued at once.

FAIRMONT & CLARKSBURG TRACTION.—Chandler Brothers & Co. and the Fidelity Trust Co., both of Philadelphia, Pa., have agreed to buy the remainder (about \$400,000) of the authorized issue of \$2,500,000 first mortgage 5 per cent. bonds of the Fairmont & Clarksburg Traction.

INTERNATIONAL & GREAT NORTHERN.—The receiver has been authorized to pay the interest due May 1 on the \$198,000 Colorado river bridge first mortgage 7 per cent. bonds.

MARSHALL & EAST TEXAS.—This is the new name of the Texas Southern, which was recently sold. (Aug. 14, p. 742.)

MISSOURI ELECTRIC.—This company, organized to take over the property of the St. Louis, St. Charles & Western, has filed a mortgage securing an issue of \$1,000,000 bonds, of which \$700,000 are to be reserved to refund present indebtedness and for extending and repairing the property. The company operates 19¼ miles of road from St. Louis, Mo., to St. Charles.

NEW YORK, NEW HAVEN & HARTFORD.—President Mellen submitted the following statement to the Public Service Commission when asked as to the uses of the \$11,000,000, with which the New York, New Haven & Hartford gained control of the Westchester and Portchester companies:

The Milbrook Co., \$99,000 of whose stock of a total of \$100,000 is owned by the New York, New Haven & Hartford, owns the following:

(1) 91,581 shares of capital stock of the New York & Portchester Railroad, par \$100; total issued 91,590 (nine shares held by directors).

(2) One temporary 5 per cent. first mortgage gold bond of New York & Portchester Railroad for \$100,000.

New York & Portchester Railroad owns:

(1) 7,260 shares capital stock of the New York, Westchester & Boston Railway, par \$100.

(2) 23,614½ shares of capital stock of New York, Westchester & Boston Railway (voting trust certificates).

(3) Five shares of capital stock of The City & County Contract Co.

6,895 shares of capital stock of The City & County Contract Co. (voting trust certificates); total number of shares issued City & County Contract Co. capital stock is 6,890.

(4) An underwriting agreement to the amount of \$13,490,000 cash to bonds and stock of New York, Westchester & Boston Railway. On this underwriting has been paid \$4,819,120. Upon payment of balance, New York & Portchester Railway will be entitled to receive 13,490-13,500 of \$15,000,000 par, 5 per cent. Westchester bonds and 45,000 shares of Westchester capital stock. These securities now being held under the syndicate agreement by Knickerbocker Trust Co., depository, for the syndicate managers.

The total amount of cash advanced by the New York, New Haven & Hartford is \$11,265,000. Of this amount \$10,873,169 was expended in acquiring the securities of the several companies as detailed above, and the remainder, \$391,830, is represented by demand notes or open account of the several companies. What securities will be issued against this amount cannot as yet be determined. The hearing was concluded.

PONTIAC, OXFORD & NORTHERN.—There were no bidders at the advertised sale of this road, the upset price being \$700,000; the purchaser to assume responsibility for \$400,000 bonds. The road runs from Pontiac, Mich., to Caseville, about 100 miles.

QUEBEC BRIDGE & RAILWAY.—The government has exercised the right, given it in the statutes of 1903, to take over the whole property of the Quebec Bridge & Railway, and has assumed liabilities aggregating \$6,500,157.

ST. LOUIS & SAN FRANCISCO.—The United States Express Co. has loaned the St. Louis & San Francisco \$2,000,000 due in three years and bearing 5 per cent. interest. The railroad company has agreed to give the United States Express Co. contracts for express service now held by the Wells Fargo Co., as these contracts expire.

SCIOTO VALLEY TRACTION.—The Harris Trust & Savings Bank, Chicago, and N. W. Harris & Co., of New York, have bought about \$1,600,000 15-year 5 per cent. bonds of September 1, 1908-1923. This is part of an authorized issue of \$4,000,000. The \$2,000,000 bonds issued in 1903, none of which have been sold, will be canceled. On September 22 the stockholders will be asked to authorize \$500,000 additional 5 per cent. cumulative first preferred stock, of which it is said \$300,000 will be sold to retire the present floating debt, and the remainder will be reserved for extensions and improvements. The company operates 72 miles of line from Columbus, Ohio, to Lancaster, and from Columbus to Chillicothe.

SOUTHERN INDIANA.—Myron J. Carpenter has been appointed receiver. The first mortgage bondholders' committee, George W. Young, Chairman, have paid coupons, due August 1, to all bondholders who deposited their bonds with the committee before noon August 24.

The first mortgage bondholders' committee, A. G. Hodenpyl, Chairman, announces that this committee will not buy the August 1 coupons.

TARRYTOWN, WHITE PLAINS & MAMARONECK (ELECTRIC).—The up-state Public Service Commission has refused the petition of the Receiver to charge 10 cents instead of five between White Plains, N. Y., and Mamaroneck. The charter of the company fixes the fare to be charged at 5 cents.

TEXAS SOUTHERN.—See Marshall & East Texas.

WABASH-PITTSBURGH TERMINAL.—The Mercantile Trust Co., New York City, on August 19, sold at auction \$663,000 Wabash-Pittsburgh Terminal 4 per cent. first mortgage bonds of 1904-1954. The price received was 40, making the total amount received \$265,200. The bonds were held as security for a loan of \$343,838.

WISCONSIN CENTRAL.—The remaining \$2,400,000 of the \$5,000,000 loan made by the United States Mortgage & Trust Co., has been paid by the syndicate which controls the Wisconsin Central. The syndicate has not been dissolved.

WISCONSIN ELECTRIC.—This company, which has taken over the property and franchises of the Winnebago Traction Co., of Oshkosh, Wis., has an authorized capital stock of \$350,000, an authorized first mortgage of \$1,250,000, and a second mortgage of \$400,000.